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ABSTRACT

Educational programs in solid waste management offered by 16 schools in 9 states were surveyed. These programs represent a sample, only, of the various programs available nationwide. Enrollment and graduate statistics are presented. Overall, 116 full-time and 124 part-time faculty were involved in the programs surveyed. Curricula and sources of research funds and student financial support are discussed. A national solid waste employment profile is presented. (BB)

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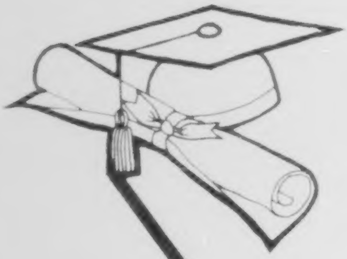

Post Secondary Education Profile

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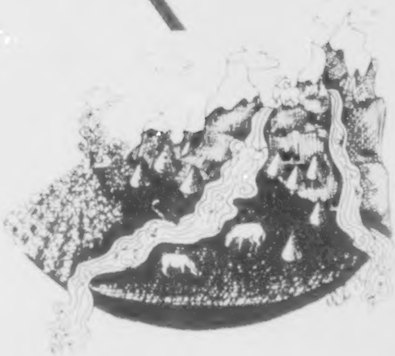
SOLID WASTE

Phase II
Of A National Environmental/Energy Workforce Assessment

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC.
P. O. Box 287
Iowa City, Iowa 52240



SE 025 208

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT

PHASE II

POST-SECONDARY EDUCATION PROFILE

SOLID WASTE

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC.

Under Grant from:

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

Grant #T900591

1978

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National
Field
Research
Center, Inc.

P.O. BOX 287 IOWA CITY, IA 52240 (319) 351-8789

HEADQUARTERS

· IOWA CITY ·
P.O. BOX 287
IOWA CITY, IA 52240
(319) 351-8789

FIELD OFFICES

· ATLANTA ·
2700 CUMBERLAND PKWY
SUITE 150
ATLANTA, GA 30339
(404) 433-2844

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2800 S. PARKER ROAD
SUITE 180, NO. 6
DENVER, CO 80232
(303) 751-4962

· WASHINGTON, D.C. ·
1522 K STREET, N.W.
SUITE 600
WASHINGTON, DC 20005
(202) 223-9136

AFFILIATE OFFICES

· CHICAGO ·
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WHEELING, IL 60090
(312) 537-8988

· SPRINGFIELD ·
22 DOWNING DRIVE
CHATHAM, IL 62629
(217) 483-2751

INTRODUCTORY NOTE

The National Environmental/Energy Workforce Assessment: Post-Secondary Education Profile was conducted by National Field Research Center, Inc. with main offices in Iowa City, Iowa. The following personnel have had primary responsibility for the development of the project report.

IOWA CITY, IOWA
Dr. Darold E. Albright, President
Paul E. Bridges, Executive Director
D. Peter Wahl, Project Director
Janet M. Henry
Amy W. Mook
Mary Kay (Edge) Wade

ATLANTA, GEORGIA
Elizabeth G. Nielsen, Regional Director
Marilyn J. Horton

DENVER, COLORADO
Nancy C. Dillenberg, Regional Director
Bruce D. Boxer

WASHINGTON, D.C.
Frank E. Smith, Project Coordinator
Jack F. Seum, Regional Director
Robert D. Oxberger
Dr. Constance Swank

Additional research and clerical assistance was provided by Margaret Fehn, Barbara Friedman, Cynthia Fruendt, Gail Gronlund, Karen Kirchoff, Sharon Leiker and Mary McCormac.

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Sincere appreciation is expressed to those persons within the United States Environmental Protection Agency, Office of Federal Activities, who provided guidance and direction throughout the term of the project: Mr. J. Donald Cook, Project officer; Mr. Joseph McCabe, and Mr. Michael Moore.

Gratitude must be expressed to the many individuals and organizations from the private sector who were most generous in their contribution to this project. Their openness and responsiveness reflect their concern regarding the training of our environmental workforce and their critical role in that effort.

REVIEW COMMITTEE

A special word of acknowledgement is extended to the following people who graciously gave of their time, knowledge and experience in order to review and comment on the information included in this volume. The efforts of this national committee were particularly insightful, and in general have been incorporated into the final report.

It must be pointed out that in all cases the individuals acknowledged below were asked only to review and comment on the material contained in the volume and to express their views regarding the representativeness of the material presented. They were not asked to endorse either the volume or the study in general, and the inclusion of their name on this list should not be considered an endorsement since such was not the intent.

In light of numerous responsibilities, it is especially important to note that these persons responded within very strict time constraints. Such a pattern reflects positively on both the individuals and the institutions and organizations which they represent.

Dr. Ronald J. Alvarez, P.E.
Professor of Engineering
Director of Continuing
   Engineering Education
Hofstra University

Richard B. Glazer, Ph.D.
Project Director Water Quality Management
Ulster County Community College

Raymond C. Loehr, Ph.D.
Director, Environmental Studies Program
Cornell University

Ross E. McKinney, Ph.D.
N.T. Veatch Professor of Environmental Engineering
University of Kansas

Richard D. Palmer, Ed.D.
Coordinator of Training Programs
University of Florida
Center for Training Research Education for Environmental Occupations (TREEO)

M.L. Rowe, Ph.D.
Department Chairman, Department of Environmental Science
East Central University
Ada, Oklahoma 74820

William W. Shuster, Ph.D.
Professor of Environmental Engineering
Rensselaer Polytechnic Institute

Dennis W. Weeter, Ph.D.
Associate Professor of Environmental Engineering
University of Tennessee - Knoxville

FOREWORD

Information for this report was largely compiled from on-site interviews with professionals in post-secondary institutions throughout the United States. On-site interviews were supplemented by telephone and/or mail contact to clarify and revalidate the data. This report presents a summary of programs in junior colleges, vocational/technical training institutes, community colleges, four-year colleges, and universities as well as other training institutions. Programs are representative of all levels from academic certification through doctoral degrees. The environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater and energy were surveyed.

This study was conducted for the United States Environmental Protection Agency by the National Field Research Center, Inc. of Iowa City, Iowa, with field offices located in Atlanta, Georgia; Denver, Colorado; and Washington, D.C.

NATIONAL ENVIRONMENTAL/ENERGY WORKFORCE ASSESSMENT

PHASE II

POST-SECONDARY EDUCATION PROFILE

SOLID WASTE
SUMMARY

SOLID WASTE

A. STATES, INSTITUTIONS, PROGRAMS AND DEGREES

Educational programs in solid waste management offered by 16 schools in 9 states were surveyed during Phase II. As some schools offer more than one program, a total of 18 programs through which 44 certificate or degree sequences are available were included. Two programs that have been discontinued are discussed because their content and fate are of significant relevance to the field. Programs included represent associate through doctoral work.

The following table depicts the number of programs surveyed by degree:

TABLE 1

SOLID WASTE DEGREES, PROGRAMS AND STATES

Degree	Number of Programs	States Visited
Associate	2*	Connecticut
Bachelor	2	Iowa
Masters	3	Michigan
Certificate (Masters level)	1	Missouri
Multiple Degree Programs		New York
Certificate/Associate	1*	North Carolina
Bachelor/Masters	2	Pennsylvania
Bachelor/Masters/Doctoral	4	Tennesseee
Masters/Doctoral	5	West Virginia
TOTAL	20	

*one no longer operable

B. ENROLLMENT STATISTICS AND GRADUATES

The most common recruitment technique is distribution of brochures on posters with tear off cards. Many programs, particularly at the graduate level, depend heavily upon university-wide recruitment and subsequent transfer to the program. Recruitment of students for associate and operator certificate programs will remain exceedingly difficult as long as mandatory education and/or certificate requirements are not imposed.

Only four programs (all graduate level) have foreign students enrolled. In-state undergraduate enrollments characteristically exceed 80% of the total. The graduate level profile is extremely variable, ranging from an out-of-state low of 10% to a high of 90%.

The following table represents the enrollment profiles of the solid waste programs surveyed during Phase II:

TABLE 2

SOLID WASTE ENROLLMENT PROFILE SUMMARY

Degree	Enrollment Full-time/Part-time			Graduates Average # Per Year	Graduate Change by Program Up / Down / Stable		
					Up	Down	Stable
Certificate	0		50	50	0	0	1
Associate	8		0	2	0	1	0
Bachelors	1,614		15	369	6	0	2
Masters	305	217[1]	152	183	10	0	13
Doctoral	51	2[1]	4	13	0	1	2
TOTAL[2]	1,978	219	221	617	16	2	18[3]

---

[1] No breakdown was available as to full-time/part-time distribution.

[2] Enrollments are for programs and are not specific to students pursuing solid waste sequence options.

[3] Not all programs responded to this question.

Caution should be employed in interpretation of the above table. Enrollment figures for programs within engineering departments often represent total departmental enrollment and are not, therefore, an accurate reflection of the actual number of students with a concentration or equivalent in the solid waste sequence. Thus, the total solid waste management enrollment of 2,418 is an inflated figure which gives the appearance of the area being more dynamic than it is. Although respondents in Phase I stated explicitly that the greatest need in solid waste management is for persons trained at the operator/landfill manager level, only two extant programs in this report are of that type. Two others included are no longer functioning due to lack of students and support.

Ten of the 18 operable programs conduct some graduate follow-up, although most have no information beyond the first job accepted. Informal word of mouth and formal program or department mail surveys are the most common proceedures.

C. FACULTY

Most programs in this sample depend wholly or largely upon faculty who are full-time within the program. Three programs are fairly evenly divided between full-time program personnel and persons based in other departments; three depend wholly, or nearly so, on other department-based faculty designated as part-time with regard to the solid waste program.

Overall, 116 (48%) faculty are full-time in programs with solid waste sequences; 124 (52%) are part-time. This ratio is somewhat distorted because the three programs which depend heavily upon other department-based faculty are large, faculty-wise, totaling 97 persons (78% of all part-time program faculty.)

D. CURRICULA

The curricula of solid waste educational programs reflect the current national emphases in solid waste management as delineated in the Resource Conservation and Recovery Act of 1976. Reduction of solid waste volume, safe disposal of hazardous wastes, resource recovery, and waste-based power generation are major components of curricula at all levels.

The programs surveyed are evidence that we are preparing people in a variety of aspects of solid waste management but only as a part of a larger field of study. What appears to be most slighted in our approach is a concerted effort to train a competent workforce for jobs requiring less than a bachelors level education.

The bulk of the programs in the report are integral parts of established engineering programs or are multidisciplinary efforts which were generated in engineering departments.

Only three programs indicated internships or applied study terms are integral components of the curriculum. As they are quite different in emphasis no comparison could be drawn among the three, nor could they be contrasted with the other programs.

Curriculum flexibility, in terms of time required to implement course and program sequence changes, appears to be typical of most academic areas. All course changes can be implemented within a year (most in time for inclusion in the next term.) The majority of program sequence changes can be implemented in a similar time frame.

There appears to be little concern for additional material needs. One respondent stated much available material is outdated. Others expressed desires for laboratory hardware and computer software for training purposes.

Respondents in engineering programs generally agreed that communication skills are a problem with students entering the program; a few stressed that this is definitely not so for their students. Many felt that required or elective course work which provide ample opportunity for practice and improvement are limited.

E. RESEARCH FUNDING AND SOURCES OF STUDENT FINANCIAL SUPPORT

Data from Phase II indicate that the most prevalent form of financial assistance to graduate students is through research funding support. Research assistantships and project employment are common. Such support is available through grants provided by such federal agencies as the Environmental Protection Agency, National Science Foundation, National Institute of Health, and the Army Corps of Engineers. State and municipal support is substantial.

Student support includes several sources and types traditionally available to people regardless of major and some which are unique to or of more than usual significance to solid waste education. University-wide scholarships are quite common, as are student loans. The work-study program is a common source of income; most undergraduate students find summer employment.

F. EMPLOYMENT

The following table shows employment data for graduates of the institutions visited which offer certificates or degrees with solid waste management sequences. Figures were provided by faculty members and were either "best estimates" or actual statistics collected.

TABLE 3

SOLID WASTE EMPLOYMENT PROFILE NATIONAL

	PRIVATE SECTOR			
Degree	Industry/	Combined*/	Consulting	Government
Certificate	40%			60%
Associate	40%		40%	20%
Bachelors	11%	34.5%	15.8%	38.7%
Masters	28.5%	30.2%	47%	62.3%
Doctoral	17.9%	23.5%	22%	37.5%
Graduate	10%	36%	19%	35%

*Several programs were unable to separate the private sector employment into the Industry/Consulting categories.

Graduates of most of the programs find employment in the private sector at a rate of 60 or 70%. Graduates of programs for which there is specific information fill consulting positions at a rate significantly greater that that for industry. Overall, public sector employment is less likely for persons with undergraduate degrees than for those with graduate degrees.

Respondents were provided a list of solid waste related occupations. They were asked to indicate positions their graduates are qualified to fill and to add appropriate occupations. The occupations most often cited were:

Degree Level	
Certificate	Recycling Operator Sanitary Landfill Equipment Operator Sanitary Landfill Operator
Associate	Landfill Operating Manager Solid Waste Management Technician
Bachelors, Masters Doctoral (No breakdown available)	Environmental Engineer Environmental Engineering Technician Sanitary Engineer Pollution Control Specialist Solid Waste Systems Manager Public Health Sanitarian/Inspector/Engineer Land Use Planner Environmental Control Technologist Environmental Monitor Specialist

PROJECT BACKGROUND

Photo reprinted from the University of Wisconsin,
Madison Oceanography and Limnology Catalog

PROJECT BACKGROUND

OVERVIEW:

In late 1975, Congress acknowledged the growing national concern for the preservation and conservation of our national resources with a direct inquiry into the availability and readiness of our environmental workforce. That inquiry has taken the form of a three-year, three-phase National Environmental/Energy Workforce Assessment, currently being conducted by National Field Research Center under the direction of the U.S. Environmental Protection Agency. In keeping with the objective of the assessment, this three-phase national effort directs itself at environmental/energy workforce needs, national educational preparedness, and the functional relationship between the two.

PHASE I:

Phase I of the National Environmental/Energy Workforce Assessment focused upon the development of "workforce demand projections" through 1982 for all public environmental agencies. This on-site assessment, which was carried out in all 50 states, Puerto Rico and the Virgin Islands, culminated in a numerical profile of the growth patterns and workforce needs at the national and state levels. Stratification of the overall definition of "environmental occupation" into seven distinct vocational areas enhanced even further the applicability of the results. In addition to this public sector workforce assessment, Phase I included an overview analysis of private sector needs (through an adjunct mail survey of selected businesses and industries) and a brief review of selected environmental educational programs.

Phase I was completed in May, 1977. The 70-volume final report included:

* National Abstract	(1)
* National Legislation	(1)
* Regional Assessments	(10)
* State Assessments (including D.C., VI and PR)	(53)
* Business and Industry Assessment	(1)
* National Summary	(4)

PHASE II:

Phase II of the National Environmental/Energy Workforce Assessment was structured around an intensive on-site inventory of representative environmental educational offerings on a national scale. The primary objective of this project has been to collect and aggregate data on training and educational programs in both the post-secondary education field and in the private sector and to do so by environmental area. Specifically, the study was designed to provide an overview of environmentally related post-secondary education programs, their program structure, representative course offerings, employment history of the graduates, and the faculty structure. Additionally, information was to be collected on program requirements and program projections.

Initially, opportunities to nominate programs for inclusion in this on-site review process was given to the Environmental Protection Agency and its program officers and regional personnel both through the

Project Officer and via direct mail requests; all state departments of education; state environmental agencies and selected media-specific associations. These nominations were supplemented by a direct review of institutional catalogs, information obtained during the first year's on-site activities, and a review of other published sources of information regarding degree programs in environmental areas. These sources are included in Appendix III - Selected Bibliography.

Following their initial development, the lists of nominees were forwarded to the program officers for suggestions regarding additions or deletions. Next, letters were written to those nominated institutions seeking their support and cooperation in the on-site review process. Several programs, some of which were highly recommended, declined the opportunity to participate giving reasons varying from lack of time to the fact that the program being inquired about no longer existed, to outright refusal to cooperate with any government study. These institutions were deleted from the final on-site process. The remainder were included in the study and are shown in Table 1 of each volume. Selection of the sample for the private sector is discussed in depth in that particular volume.

In preparation for the on-site interviews, appropriate persons were contacted in the institution involved and were given a background description of the study, a suggested timetable for the interview process and were told what kind of information was being sought. This was all done in an effort to keep the time involvement of the individual contact persons at a minimum. During the actual on-site interview, generally lasting around one hour, the information was collected, questions asked and answered, and further informational contacts identified. Following this process, each on-site interview was written up in the form of a Training Program Summary, which where time allowed, was returned to the contact person for critiquing prior to inclusion in the report.

Throughout this process, individuals and institutions were given assurance that this study was not an attempt to evaluate program offerings and every attempt has been made on the part of the writers to live up to this assurance. Inclusion in this report provides no assurances of quality, nor should a program's exclusion be consideration of the lack thereof. In many instances certain programs within an institution were not included while others were, primarily due to the determination of the sample - previously discussed. This too should not be viewed in any qualitative manner.

REPORT ORGANIZATION:

The final report, of which this volume is a part, consists of volumes depicting a training profile in each medium under consideration, namely,

Air
Energy
Noise
Pesticides
Potable Water
Radiation
Solid Waste
Wastewater
Composite
Business and Industry and Trade Associations

At the outset it should be pointed out that there are very few degree programs conveying degrees in a particular medium; rather, degrees are offered in various specialties which lend themselves to obtaining employment in one or more of these fields. Nonetheless, to obtain maximum utility for the funding agency, programs were reported in this fashion. The Composite section was necessitated by the number of programs offering course work in multiple fields and differing specializations resulting from course selection. For convenience in handling of the data Potable Water, Wastewater and Composite have been reported in multiple volumes because of the numbers involved. Although separated into volumes either by degree level of the programs involved, as in the case of Potable Water and Wastewater, or by content as in the case of Composite, persons interested in any of these fields would be well advised to review each of the volumes to assure more complete coverage.

Along with the standard introductory pages common to volumes of this nature, each volume contains sections on Project Background, Introduction (consisting of sections devoted to a description of the programs surveyed and covered in the volume), Project Commentary, and the Training Summaries along with the Appendices.

REVIEW PROCESS:

In addition to individual training summary reviews conducted by the persons initially interviewed, each volume has been reviewed internally, by persons in the Environmental Protection Agency and by a select group of review committee members. In the final instance, individuals met during the on-site process were nominated by interviewers for inclusion on the review committee, primarily as a result of their obvious expertise in the field and their evidenced interest in the project.

These persons were then contacted by mail or by telephone in an effort to determine their willingness to serve. The rather stringent timelines necessary to keep the project on course and to deliver the finished product as specified were also detailed. In excess of one hundred persons returned their volumes (out of a mailing of 120) and all but five of these provided usable responses. In these five instances either last minute job demands prevented them from carrying out the review in the short timelines, or (in two instances) individuals indicated that they wanted nothing to do with the process. This particular method of review provided a wealth of valuable information, suggestions for revision of specific elements, and general comments helpful in revising the final documents. In all cases an effort was made to seriously consider and incorporate reviewer suggestions. The persons on the various review committees are individually acknowledged in the front of the volume they reviewed.

Photo reprinted from the University of Missouri, Columbia Bulletin 1977.

INTRODUCTION

Photo reprinted from the Northland College Catalog 1975-76

INTRODUCTION

Solid Waste has been a problem of increasing magnitude and complexity confronting people dating from the beginning of the first permanent settlement. It is perhaps the oldest form of pollution. Recognition of solid waste as a pollution problem of national concern is a recent development. This national concern is reflected in a change in terminology over the last decade; we no longer speak so much of solid waste disposal as solid waste management. The most recent culmination of this increasing concern and redifinition of the problem is the passage and implementation of the Resource Conservation and Recovery Act (RCRA) of 1976, which succeeded the expired National Solid Waste Disposal Act.

Reduction of solid waste volume, safe disposal of hazardous wastes, resource recovery, and waste-based power generation are current emphases in solid waste management efforts. These emphases are reflected in the curricula of solid waste educational programs at all degree levels

The programs included in this volume are evidence that we are preparing people in a variety of aspects of solid waste management, but not nearly to the extent (in terms of numbers of students) as was anticipated in the early years of this decade. Particularly slighted in our approach is a concerted effort to train a competent workforce for jobs requiring less than a bachelors level education. Support, in terms of money for programs and meaningful incentives for student participation, is lacking at this critical level.

The bulk of the solid waste programs discussed in this report are an integral part of an established engineering program or are multidisciplinary efforts which were generated in engineering departments. Concentration on solid waste engineering is greatest at the graduate level. Notable exceptions are the Environmental Health Program at Yale; the B.S. degree in Environmental Resource Management at The Pennsylvania State University; and the certificate and associate programs formerly available at Wilson County Technical College.

Each of the programs surveyed in solid waste is described individually in the Solid Waste Educational/Training Summaries section of this report. The summaries include program descriptions which detail program structure and requirements; a faculty, student, and graduate profile; and a program projection commentary.

The reader is also referred to Table 9 which provides data summaries for the degree programs as to such variables as enrollment, graduates, faculty, graduate employment, and applied study term programs. Additional information is presented on these programs in narrative and tabular form, which are detailed in the Table of Contents.

For a complete listing of all schools and programs included in the Phase II study, see Table 1, which follows.

TABLE I

PARTICIPATING INSTITUTIONS

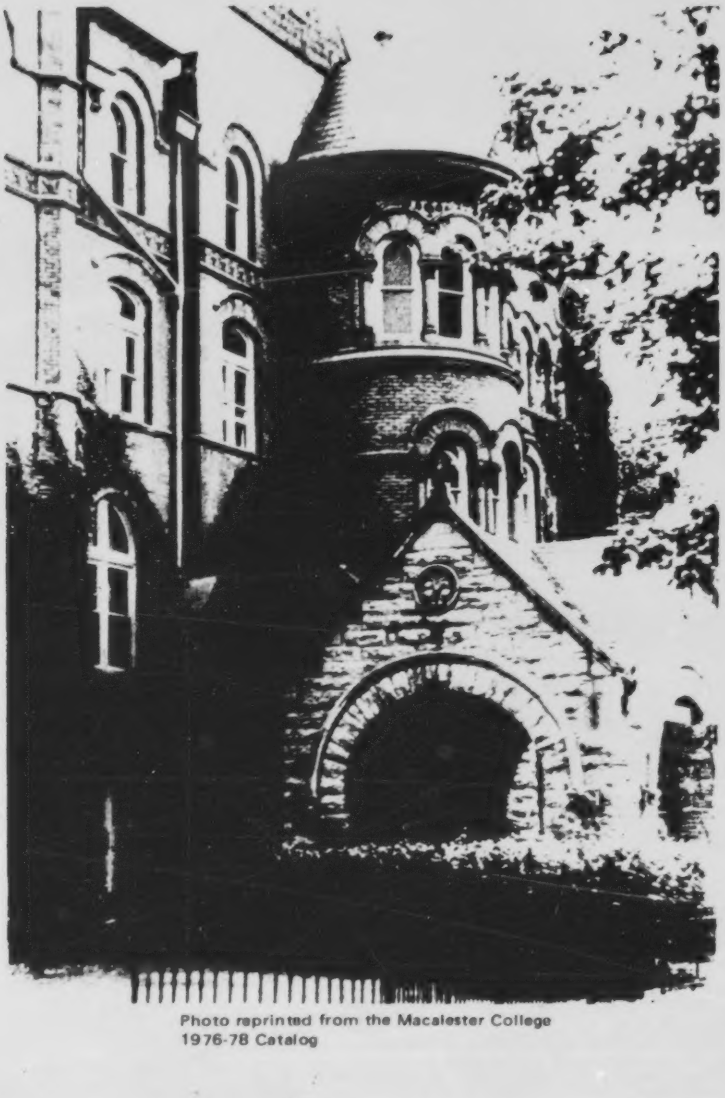

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Table 1 is a comprehensive listing of all institutions which participated in the post-secondary educational profile of the National Environmental/Energy Workforce Assessment. Listed by state, institution, and degree are programs surveyed in the areas of air, energy, noise, pesticides, potable water, radiation, solid waste and wastewater.

An explanation of the degree abbreviations utilized within the report may be found in Appendix I, entitled "Degree Abbreviations". For a complete listing of the institutions visited in a media specific area (i.e., air, energy, etc.), attention is drawn to Appendix IV, entitled "Participating Institutions by Environmental Category".

The Table in part III of the Project Findings, entitled "A Summary Profile of Representative Educational Programs" follows the narrative and is a presentation of specific institutions visited for the particular volume.

TABLE I

PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)*
AL	University of Alabama University	Environmental Engineering	M.S. (3)
AK	University of Alaska Fairbanks	Environmental Quality Engineering Science	M.S.
AR	University of Arkansas Fayetteville	Agricultural Engineering	B.S. M.S. Ph.D.
		Civil Engineering	M.S.C.E.
		Environmental Engineering	M.S.En.E.
		Environmental Science	B.S.
CA	California Institute of Technology Pasadena	Environmental Engineering Science	M.S. Ph.D.
	California Polytechnic State University San Luis Obispo	Environmental Engineering	B.S.
	California State University-Sacramento Sacramento	Civil and Environmental Engineering	B.S. M.S.
	Stanford University Stanford	Environmental and Water Studies	M.S. Ph.D.
	University of California-Berkeley Berkeley	Nuclear Engineering	B.S. M.S. M.E. Ph.D. D.E.
		Pest Management	B.S.
		Sanitary Engineering	M.S. M.E. Ph.D.
	University of California-Davis Davis	Environmental Toxicology	B.S.
		Plant Protection and Pest Management	M.S.

TABLE I

PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of California-Davis (Cont'd)	Entomology	B.S. M.S. Ph.D.
	University of California-Riverside Riverside	Pest Management	M.S.
	University of California-Santa Barbara Santa Barbara	Environmental Studies	B.A.
CO	Colorado State University Fort Collins	Environmental Engineering (Civil)	M.S. Ph.D.
	Community College of Denver-Red Rocks Golden	Water-Wastewater Technology	A.A.
CT	Hartford State Technical College Hartford	Nuclear Engineering Technology	A.S.
	Yale University New Haven	Environmental Health	M.P.H.
DE	Delaware Technical and Community College Newark	Environmental Engineering Technology	A.A.S.
	University of Delaware Newark	Entomology and Applied Ecology	B.S.
		Environmental Engineering	M.A.S. M.E. Ph.D. (App. Science) Ph.D. (ChE)
DC	Catholic University Washington	Civil Engineering	B.S.
	Howard University	Environmental Engineering	M.E.

TABLE I

PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
FL	Broward Community College Fort Lauderdale	Pest Control Technology	A.S.
	Central Florida Community College Ocala	Radiological Health Technology	A.S.
	Florida International University Miami	Environmental Studies	B.A. B.S.
		Environmental Engineering Technology	B.S.
	Heed University Hollywood	Ocean and Environmental Affairs	M.A. Ph.D.
	Miami-Dade Community College Miami	Environmental Engineering Technology	A.S.
		Marine Science Technology	A.S.
	University of Florida Gainesville	Air Pollution	M.E. M.S. Engineer Ph.D.
		Environmental Biology	M.E. M.S. Engineer Ph.D.
		Environmental Resources Management Activities	M.E. M.S Engineer Ph.D.
		Systems Ecology	M.E. M.S. Engineer Ph.D.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Florida (Cont'd)	Water Supply and Water Pollution Control	M.E. M.S. Engineer Ph.D.
		Nuclear Engineering	B.S.(N.E.) B.S.E.(N.E.) M.E. M.S. Engineer Ph.D.
		Radiological Sciences	M.E. M.S.
	University of Miami Miami	Marine and Atmospheric Science	M.S. Ph.D.
GA	Abraham Baldwin Agricultural College Tifton	Plant Protection	A.Ag.
	Atlanta University Center/ Georgia Institute of Technology Atlanta	Water Pollution Control Design Engineering	B.S. B.E.
	Georgia Institute of Technology Atlanta	Acoustical Engineering	Advanced Cert.
		Energy Engineering	Advanced Cert.
		Environmental Studies	Advanced Cert.
	Southern Technical Institute Marietta	Nuclear Safety	A.S.
	University of Georgia Athens	Entomology	B.S. A.B. M.S. M.P.P.P.M. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Georgia (Cont'd)	Environmental Health Science	B.S.E.H.
HI	University of Hawaii Honolulu	Environmental and Sanitary Engineering	M.S.
IL	Illinois Institute of Technology Chicago	Environmental Engineering	B.S.E.S. M.S. Ph.D.
	Prairie State Community College Chicago Heights	Air, Water, Wastewater	A.A.S.
	Sangamon State University Springfield	Environments and People	B.A. M.A.
	Southern Illinois University-Edwardsville Edwardsville	Wastewater Treatment Operator Training	Cert.
IN	Indiana University Bloomington	Environmental Programs	Cert. A.S. B.A. B.S. M.P.A. M.S.E.S. Ph.D. (minor)
	Purdue University West Lafayette	Environmental Sciences Option	B.S.
		Nuclear Engineering	B.S.N.E. M.S. Ph.D.
IA	Iowa State University Ames	Environmental Studies	B.A. B.S.
		Sanitary Engineering and Water Resources	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Kirkwood Community College Cedar Rapids	Environmental Health Assistant	Diploma
		Environmental Health Technician	A.A.
		Water and Wastewater	Diploma
	University of Iowa Iowa City	Environmental Engineering	M.S. Ph.D.
		Environmental Toxicology	M.S. Ph.D.
KS	Kansas State University Manhattan	Chemical Engineering	B.S. M.S. Ph.D.
		Mechanical Engineering	B.S. M.S. Ph.D.
		Nuclear Engineering	B.S. M.S. Ph.D.
		Sanitary Engineering	M.S.C.E.
	University of Kansas Lawrence	Environmental Health Engineering	M.S. Ph.D.
		Environmental Health Science	M.S. Ph.D.
		Environmental Studies	B.A.
		Radiation Biophysics	B.A. B.S. M.S. Ph.D.
		Water Resources Engineering and Science	M.S. Ph.D.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
KY	Morehead State University Morehead	Environmental Studies	B.S. A.B.
		Mining Technology	A.A.S.
	Pikeville College Pikeville	Mining Technology	A.M.T.
	University of Kentucky Lexington	Energy (Coal) Engineering	M.S. Ph.D.
		Environmental Engineering	M.S. Ph.D.
	University of Louisville Louisville	Environmental Engineering	B.S. M.Eng.
	Western Kentucky University Bowling Green	Environmental Science	B.S.
		Environmental Engineering	B.S.
LA	Delgado College New Orleans	Urban Pest Management	A.S.
		Water/Wastewater Technology	A.S.
		Environmental Health Technology	A.S.
	McNeese State University Lake Charles	Environmental Science	B.S. M.S.
ME	Eastern Maine Vocational Technical Institute Bangor	Environmental Control Technology	A.A.S.
	New England Regional Wastewater Institute (S. Maine Vocational Technical Institute) S. Portland	Wastewater Treatment Technology	Cert.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Maine-Orono Orono	Sanitary Engineering	M.S.C.E. Ph.D.
MD	Charles County Community College La Plata	Pollution Abatement Technology	A.A.
	Johns Hopkins University Baltimore	Environmental Engineering	M.A. M.S.E. M.S. Ph.D
	University of Maryland College Park	Environmental Engineering	M.S.
		Nuclear Engineering	M.S.
		Pest Management	M.S.
MA	Harvard University Cambridge	Environmental Health Sciences	S.M. Sc.D.
		Environmental Sciences and Engineering	S.M. M.E. Ph.D.
		Toxicology	S.M. Sc.D.
	Massachusetts Institute of Technology Cambridge	Acoustics	S.M. Sc.D./Ph.D.
		Environmental Engineering	Env.E.
		Mineral Resources Engineering and Management	S.M. Engr. Sc.D./Ph.D.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Massachusetts Institute of Technology (Cont'd)	Nuclear Engineering	S.B. S.M. N.E. Sc.D./ Ph.D.
		Water Resources and Environmental Engineering	S.B. S.M. Sc.D./ Ph.D.
		Wastewater Treatment Plant Operations	Cert.
	Northeastern University Boston	Environmental Engineering and Science	M.S.
	Springfield Technical Community College Springfield	Environmental Technician	A.S.
	Tufts University Medford	Environmental Health Engineering	B.S.C.E. M.S.
	University of Lowell Lowell	Radiological Health Physics/Radiological Sciences and Protection	B.S. M.S.
		Wastewater Treatment Plant Operations	Cert.
MI	Ferris State College Big Rapids	Environmental Health Technician	A.A.S.
		Environmental Health	B.S.
	Michigan State University East Lansing	Environmental Conservation Education	M.S. Ph.D.
		Environmental Engineering	B.S.C.E. M.S. (emphasis) Ph.D. (emphasis)

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Michigan State University (Cont'd)	Natural Resources and Environmental Education	B.S.
		Systems Science (Ecological Systems)	B.S. M.S. Ph.D.
	Michigan Technological University Houghton	Environmental Engineering	B.S.C.E. B.S.E. M.S.C.E.
	University of Michigan Ann Arbor	Environmental Education	M.S.
		Environmental Sciences Engineering	B.S.
		Industrial Hygiene and Air Pollution	M.P.H. M.S. Dr.P.H. Ph.D.
		Radiological Health	M.P.H. M.S. Dr.P.H. Ph.D.
		Water Resources: Engineering	M.S.E. Ph.D.
		Management Science	M.S. Ph.D.
		Water Quality	M.P.H. M.S. Dr.P.H. Ph.D.
MN	Bemedji State College Bemedji	Environmental Studies	B.S. M.A.
	Macalester College St. Paul	Environmental Studies	B.A. B.S.
	University of Minnesota Minneapolis	Environmental Health	M.P.H. M.S. Ph.D.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
MS	Mississippi State University Mississippi State	Specialized Training in Pest Management	M.Ag.
MO	Missouri Southern State College Joplin	Environmental Health Technology	A.S. B.S.
		Radiologic Technology	A.S.
	St. Louis Community College at Forest Park St. Louis	Radiologic Technology	A.S.
	University of Missouri-Columbia Columbia	Sanitary Engineering	B.S. M.S. Ph.D.
	University of Missouri-Rolla Rolla	Environmental and Sanitary Engineering	M.S. Ph.D.
	Water and Wastewater Technical School Neosho	Water and Wastewater Training	Cert.
	Washington University St. Louis	Air (emphasis)	M.S. D.Sc.
MT	Montana State University Bozeman	Environmental Engineering	M.S.
		Environmental Health Technology	M.S.
	Northern Montana College Havre	Environmental Health Technology	A.A. Cert.
NE	Central Technical Community College Hastings	Agriculture Technology	Cert. 1-Year Diploma 2-Year Diploma A.A.S. A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Nebraska Lincoln	Sanitary Engineering	B.S. M.S. Ph.D.
		Water Resources Engineering	M.S.
		Planning and Management	M.S.
NH	University of New Hampshire Durham	Entomology	B.S. B.A.
NJ	Middlesex County College Edison	Environmental Health Science Technology	A.A.S.
	New Jersey Institute of Technology Newark	Interdisciplinary Studies in Environmental Engineering	M.S.
	Princeton University Princeton	Energy Conversion and Resources	Topical Programs
	Rutgers-SUNJ New Brunswick	Biology (option in entomology)	B.S. B.A.
		Entomology and Economic Zoology	M.S. M.P. Ph.D.
		Environmental and Business Economics	B.S.
		Environmental Science	M.S. Ph.D.
		Environmental Studies	B.S.
		Environmental and Water Resources Engineering	M.S. Ph.D.
		International Environmental Studies	B.A. B.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Rutgers-SUNJ (Cont'd)	Radiation Sciences	M.S. Ph.D.
	Stevens Institute of Technology Hoboken	Air Pollution Control Engineering	Cert.
		Water and Wastewater Engineering	Cert.
NM	New Mexico State University Las Cruces	Pest Management	B.S.
	University of New Mexico Albuquerque	Nuclear Engineering	M.S. Ph.D.
NY	Clarkson College Potsdam	Civil and Environmental Engineering	B.S. M.S.
	Columbia University New York City	Nuclear Engineering	B.S. M.S. Nuc.Engr. Eng.Sc.D.
	Cornell University Ithaca	College Program in Energy Conversion	B.S.
		Environmental Engineering	B.S. M.S. M.Eng. Ph.D.
		Waste Management Engineering	M.S. M.Eng. M.P.S. Ph.D.
		Nuclear Engineering	M.Eng. M.S. Ph.D.
	Hofstra University Hempstead	Solid Waste Management	Cert.
	Hudson Valley Community College Troy	Public Health Technology (Environmental option)	A.A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Hunter College New York City	Environmental Health Science	B.S. M.S.
	Manhattan College New York City	Environmental Engineering and Science	M.S. M.E.
	Polytechnic Institute of New York New York City	Energy Engineering and Policy	Cert. M.S.
		Environmental Engineering and Planning	M.S.C.E. M.E.H.S. Engr. Ph.D.
	Rensselaer Polytechnic Institute Troy	Environmental Engineering	B.S. M.E. M.S. D.E. Ph.D.
		Nuclear Engineering	B.S. M.S. M.E. Ph.D.
	Rochester Institute of Technology Rochester	Civil Engineering Technology (Environmental option)	B.T.
	State University of New York-Buffalo Buffalo	Water Resources and Environmental Engineering	B.S. M.S. Ph.D.
	State University of New York Farmingdale	Pest Control Technology	A.A.S.
	Syracuse University Syracuse	Chemical Engineering	B.S. M.S. Ph.D.
		Environmental Engineering	B.S.
		Sanitary Engineering, Sanitary Science, Civil Engineering	M.S.(S.E.) M.S.(S.S.) Ph.D.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	The Cooper Union New York City	Integrated Master's Program with concentration in Environmental Engineering	M.E.
	Ulster County Community College Stone Ridge	Water Quality Management Training	A.A.S.
	University of Rochester Rochester	Toxicology Training Program	M.S. Ph.D.
NC	Duke University Durham	Environmental Management	M.E.M.
		Civil Engineering/ Urban and Environmental Engineering	M.S. Ph.D.
	North Carolina State University Raleigh	Agricultural Pest Control	A.A.S.
		Pest Management	B.S. M.S. (minor)
		Air Conservation	M.S. (minor) M.E. (minor) Ph.D.(minor)
		Environmental Engineering	M.S. M.C.E. Ph.D.
		Acoustic, Noise Vibration	M.S. M.M.E. Ph.D.
	University of North Carolina Chapel Hill	Air and Industrial Hygiene	M.S. M.S.P.H.
		Environmental Chemistry and Biology	M.S. M.S.P.H. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of North Carolina (Cont'd)	Environmental Management Protection	M.S. M.S.P.H. Ph.D.
		Radiological Hygiene	M.S. M.S.P.H. Ph.D.
		Water Resources Engineering	M.S. M.S.P.H. M.S.E.E. Ph.D.
	Wilson County Technical Institute Wilson	Sanitary Landfill Operating Manager	Cert. Diploma A.A.S.
		Sanitary Landfill Technology	A.A.S.
ND	North Dakota State School of Science Wahpeton	Environmental Science Technology	A.A.
OH	Antioch College Yellow Springs	Environmental Studies	B.S.
	Hocking Technical College Nelsonville	Environmental Health Technology	A.A.S.
	Miami University Oxford	Environmental Science	M.En.
	Muskingum Area Technical College Zanesville	Environmental Quality Control Technology	A.A.S.
		Natural Resources Conservation Technology	A.A.S.
		Petroleum Engineering Technology	1-Year Cert. A.A.S.
	Ohio State University Columbus	Agricultural Engineering	B.S. M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Ohio State University (Cont'd)	Chemical Engineering (air)	B.S. M.S. Ph.D.
		Civil Engineering	B.S. M.S. Ph.D.
		Environmental Biology	M.S. Ph.D.
		Environmental Education	B.S.(Ed.) B.S.(N.R.) M.S. Ph.D.
		Toxicology (Pharmacology)	M.S. Ph.D.
	Ohio University Athens	Environmental Studies	M.S.
	Raymond Walters General and Technical College (University of Cincinnati) Cincinnati	Environmental Control/ Protection Technology	A.S.
	University of Cincinnati Cincinnati	Air Pollution and Industrial Hygiene	M.S. Ph.D.
		Civil and Environmental Engineering	M.S. Ph.D.
		Environmental Health	M.S. Ph.D.
		Mechanical and Industrial Engineering (noise)	B.S. M.S. Ph.D.
		Occupational Medicine	M.S. Ph.D.
		Toxicology	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	University of Cincinnati (Cont'd)	Acoustics and Noise Control	B.S. M.S. Ph.D.
	University of Toledo Toledo	Chemical Engineering, Civil Engineering	B.S. M.S.
		Engineering Science	M.S.
OK	East Central Oklahoma State University Ada	Environmental Science	B.S.
	OSU Oklahoma City Technical Institute Oklahoma City	Civil Technology	A.S.
	Oklahoma State University Stillwater	Engineering Technology	A.D. B.S.
		Radiation and Nuclear Engineering Technology	A.D. B.S.
	Oscar Rose Junior College Midwest City	Wastewater Technology	A.A.S.
		Environmental Science	A.A.S.
	University of Oklahoma Norman	Environmental Science	B.S. M.S. Ph.D.
OR	Linn-Benton Community College Albany	Wastewater Technology	A.S.
		Water/Wastewater Technology	A.S.
		Water/Wastewater Plant Operator	Cert.
	Oregon Institute of Technology Klamath Falls	Environmental Technology	A.A.S. B.T.
	Oregon State University Corvallis	Nuclear Engineering Technology	B.S.
		Nuclear Engineering	B.S. M.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Oregon State University (Cont'd)	Pest Management and Plant Pathology	B.S. M.S.
	Portland State University Portland	Engineering and Applied Science	B.S. M.S.
PA	Carnegie-Mellon University Carnegie Institute of Technology Pittsburgh	Environmental Engineering	B.S. M.S. Ph.D.
	Drexel University Philadelphia	Environmental Engineering and Science	M.S.E.E. M.S.E.S. Ph.D.
	Pennsylvania State University University Park	Acoustics	M.E. M.S. Ph.D.
		Air Pollution Control Technology	A.A.P.C.T.
		Entomology	B.S. M.Agr. M.S. Ph.D.
		Environmental Engineering	B.S. M.S. M.E.E.E. Ph.D.
		Environmental Pollution Control	M.S. M.E.P.C. M.E.
		Environmental Resource Management	B.S.
		Minerals Processing	M.S. Ph.D.
		Mining Technology	A.A.S.

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PARTICIPATING INSTITUTIONS

STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Pennsylvania State University (Cont'd)	Mining Engineering	B.S. M.S. M.E. Ph.D.
		Nuclear Engineering Technology	A.N.E.T.
		Nuclear Engineering	B.S. M.S. M.E. Ph.D.
		Petroleum and Natural Gas Engineering	B.S. M.S. Ph.D.
		Water Resources Engineering Technology	B.T.
	Slippery Rock State College Slippery Rock	Environmental Studies	B.S.
	Temple University Philadelphia	Environmental Technology	A.T.
		Environmental Engineering Technology	B.S.
	University of Pennsylvania Philadelphia	Energy Engineering	M.S.E.
		Energy Management and Policy	M.S.E.M.P. Ph.D.
	University of Pittsburgh Pittsburgh	Environmental and Sanitary Engineering	B.S. M.S. Ph.D.
		Environmental Systems Engineering	degrees granted through Engr. Dept.
	School of Public Health (University of Pittsburgh) Pittsburgh	Acoustic Environmental Control	M.S.(Hyg.) D.S.(Hyg.)
		Air Resources	M.S.(Hyg.)

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	School of Public Health (University of Pittsburgh) (Cont'd)	Environmental Health Engineering	M.P.H. D.S.(Hyg.)
		Environmental Health Planning	D.S.(Hyg.)
		Health Aspects of Water Quality	M.S.(Hyg.)
		Industrial Hygiene	M.S.(Hyg.)
		Toxicology	D.S.(Hyg.) Ph.D.
		Radiation Health	M.S.(Hyg.) D.S.(Hyg.) Ph.D. D.P.H.
RI	University of Rhode Island Kingston	Environmental Engineering	B.S. M.S. Ph.D.
SC	Clemson University Clemson	Air Pollution	M.S. M.Engr.
		Natural Systems	M.S. M.Engr.
		Planning and Management	M.S. M.Engr.
		Water Treatment Systems	M.S. M.Engr.
		Environmental Systems Engineering	Ph.D.
	Greenville Technical College Greenville	Wastewater Technology	A.A.S.
	Sumter Area Technical College Sumter	Environmental Engineering Technology	A.E.T.
TN	Chattanooga State Technical Community College Chattanooga	Environmental Science Technology	A.S.
		Nuclear Technology	A.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	East Tennessee State University Johnson City	Environmental Health	B.S.E.H. M.S.E.H.
	Memphis State University Memphis	Audiology	M.A. Ph.D.
	Middle Tennessee State University Murfreesboro	Environmental Science and Technology	B.S.
	State Technical Institute at Memphis Memphis	Environmental Engineering Technology	A.E.
	University of Tennessee Knoxville	Environmental Engineering	M.S.E.E. M.E. Ph.D.
		Environmental Engineering (Air Quality and Pollution Control)	M.S.E.E. M.E. Ph.D.
		Environmental Engineering (Water Pollution Control/ Water Resources)	M.S.E.E. M.E. Ph.D.
		Industrial Audiology	M.A.
		Nuclear Engineering	B.S. M.E. M.S. Ph.D.
		Water Resources Development	M.S.
	Vanderbilt University Nashville	Environmental and Water Resources Engineering (EWRE)	B.E.
		Environmental Science	B.S.
		EWRE (Environmental Science)	M.S. M.Eng. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
	Vanderbilt University (Cont'd)	EWRE (Air Resources)	M.S. M.Eng. Ph.D.
		EWRE (Solid Waste)	M.S. M.Eng. Ph.D.
		EWRE (Water and Wastewater Treatment/Water Resources)	M.S. M.Eng. Ph.D.
TX	Baylor University Waco	Institute of Environmental Studies	B.A. B.S.
	Lamar University Beaumont	Environmental Science	B.S.
		Energy Resource Management	B.S.
	Rice University Houston	Environmental Science and Engineering	M.S.
	Sam Houston State University Huntsville	Environmental Science	B.S.
	Texas A & M University College Station	Environmental Engineering	M.S. Ph.D.
		Entomology	M.S.
		Entomology/Pest Management Option	M. Ag.
	Texas State Technical Institution Waco	Nuclear Technology	A.A.S.
		Water/Wastewater Technology	A.A.S.
		Water Utility Operator	Certificate
	University of Texas Austin	Environmental Health Engineering	M.S. Ph.D.
		Water Resources Engineering	M.S. Ph.D.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
UT	Brigham Young University Provo	Chemical Engineering	B.S. M.S.
		Water Resources and Environmental Engineering	B.S. M.S.
	University of Utah Salt Lake City	Civil Engineering	B.S. M.E. M.S. Ph.D.
	Utah State University Logan	Civil and Environmental Engineering	B.S. M.S. Ph.D.
		Pest Management	B.S. M.S.
		Environmental Studies	B.S.
VA	George Washington University NASA-Langley Institute Hampton	Acoustics	M.S. Sc.D.
		Environmental Modeling	M.S.
	J.Sargeant Reynolds Community College Richmond	Environmental Technology Environmental Operations	Cert. A.A.S.
		Ground Water Resources	Cert.
	Virginia Polytechnic Institute and State University Blacksburg	Civil Engineering Technology	B.S.
		Sanitary Engineering/Environmental Sciences and Engineering/Civil Engineering	M.S. Ph.D.
	Wytheville Community College Wytheville	Environmental Technology	Cert.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
WA	The Evergreen State College Olympia	Coordinated Studies	B.A.
	University of Washington Seattle	Environmental Studies	B.A. B.S.
		Air Resources	M.S. Ph.D.
	Washington State University Pullman	Environmental Science	B.S. M.S.
		Chemical Engineering	M.S.
		Air Pollution Control Engineering	M.S.
		Air Pollution Science	M.S.
		Air Pollution Option	M.S.
		Air Pollution Program	M.S.
	Western Washington University Bellingham	Environmental Studies	B.S.
WV	Bluefield State College Bluefield	Mining Engineering Technology	A.S. B.S.
	West Virginia Institute of Technology Montgomery	Mining Engineering Technology	A.S.E.M.T. B.E.M.T.
	West Virginia University Morgantown	Engineering of Mines	B.S.
		Environmental Engineering	M.S.C.E. M.S.E.
		Mineral Processing Engineering	B.S. M.S.
		Mineral Resource Economics	M.S.
		Petroleum Engineering	B.S. M.S.

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STATE	INSTITUTION	PROGRAM TITLE	DEGREE(S)
WI	Marquette University Milwaukee	Environmental Engineering	B.A. B.S.
	Northland College Ashland	Environmental Studies	B.A.
	University of Wisconsin-Green Bay Green Bay	Environmental Emphasis	B.A. B.S. M.E.A.S.
	University of Wisconsin-Madison Madison	Civil and Environmental Engineering	B.S.
		Environmental Communications	M.A. M.S.
		Water Resources Management, Environmental Monitoring, Land Resources	M.S. Ph.D.
	University of Wisconsin-Milwaukee	Atmospheric and Marine Environmental Program	M.S. M.E.
WY	Casper College Casper	Water Quality Technology	A.S.
	University of Wyoming Laramie	Civil Engineering	M.S. Ph.D.

Other Programs

The following programs were included in the on-site visit process and offer training through various institutes, centers, state agencies, or college consortiums. Program descriptions can be found in the volume specified.

State	Institution	Program	Volume
FL	Florida Department of Environmental Regulation	Environmental Noise Control Training	Noise
	Miami-Dade Community College	NPDES Effluent Monitoring Training	Wastewater I
		Wastewater Treatment Plant Operations	Wastewater I
		Water Treatment Plant Operations	Potable Water I
	University of Miami School of Medicine	Pesticide Protection	Pesticides
KS	Kansas State University	Institute for Environmental Research	Composite II III Business and Industry
MI	Michigan State University	Institute of Water Research	Potable Water I
		Pesticide Research Center	Pesticides
NE	University of Mid-America	Pests, Pesticides and Pesticide Safety	Pesticides

State	Institution	Program	Volume
NJ	Princeton University	Environmental Science and Policy	Composite I
NC	U.S. Environmental Protection Agency	Air Pollution Training Institute	Air
OH	Ohio State University	Center for Lake Erie Area Research	Potable Water I
		Cooperative Extension Service Activities	Composite II and III
		Water Resources Center	Potable Water I
PA	Air Pollution Control Association	Refresher, Continuing Education Courses	Air
	University of Pittsburgh	Environmental Systems Engineering	Composite I
TN	Memphis State University	Nuclear Reactor Fundamentals	Energy
		Radiation Technician Training Course	Radiation
	Oak Ridge Associated Universities	Radiation Emergency Assistance Center/ Training Site	Radiation
		Special Training	Energy Radiation
	University of Tennessee Center For Health Sciences	Training Courses in Audiometric Orientation	Noise

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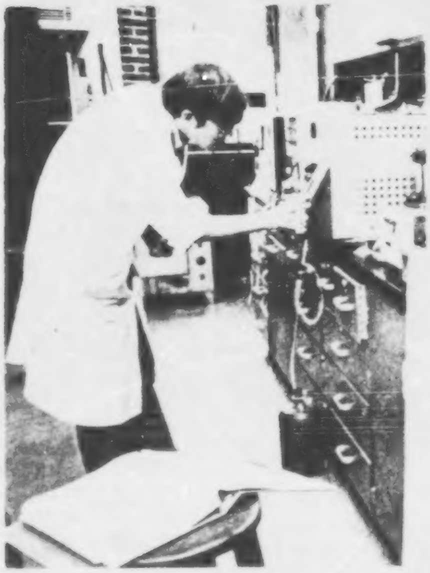
PROJECT FINDINGS



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I. A SUMMARY PROFILE OF REPRESENTATIVE SOLID WASTE EDUCATIONAL PROGRAMS

A. States, Institutions, Programs and Degrees

Information for this segment (Phase II) of the National Environmental/Energy Workforce Assessment was obtained through on-site visits and follow-up correspondence with faculty and staff of colleges, universities and training institutions in forty-five states. Solid waste education programs offered by 16 schools in 9 states were surveyed.

This report contains detailed information describing fifteen solid waste programs in which 18 certificate or degree sequences are offered. Programs no longer available are also discussed because the content and fate of these programs are of significant relevance to the field. Selection of programs to be included was based on a variety of factors including: information and recommendations obtained during Phase I of the project; recommendations by state, regional, and federal environmental personnel; a review of other published sources of information regarding certificate and degree programs in environmental areas.

On-site visits and extensive interviews were conducted to explore each of these programs in depth. Many of the institutions visited offer programs in several environmental areas. Only the solid waste programs are included in this volume. Table 2 lists the programs by region, state, and institution.

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TABLE 2

SOLID WASTE OPTION AND DEGREE PROGRAMS BY REGION, STATE AND INSTITUTION

Region	State	Institution	Program	Degree
I	CT	Yale University	Environmental Health	M.P.H.
II	NY	Clarkson College	Civil and Environmental Engineering	B.S. M.S.
		Cornell University	Waste Management Engineering	M.S. M.E. M.P.S. Ph.D.
		Hofstra University	Solid Waste Management	Cert.
		Rensselaer Polytechnic Institute	Environmental Engineering	B.S. M.S. M.E. Ph.D.
III	PA	Carnegie-Mellon University Carnegie Institute of Technology	Environmental Engineering	B.S. M.S. M.E. Ph.D.
		Drexel University	Environmental Engineering and Science	M.S.E.E. M.S.E.S. Ph.D.
		Temple University	Environmental Technology	A.T.
			Environmental Engineering Technology	B.S.
		The Pennsylvania State University	Environmental Engineering	B.S. M.S. M.E. Ph.D.
			Environmental Pollution Control	M.S. M.E.P.C. M.E.

Region	State	Institution	Program	Degree
		The Pennsylvania State University (cont.)	Environmental Resource Management	B.S.
		University of Pittsburgh	Environmental and Sanitary Engineering	B.S. M.S. Ph.D.
	WV	West Virginia University	Environmental Engineering	M.S.C.E. M.S.E.
IV	NC	Wilson County Technical Institute	Sanitary Landfill Operating Manager	formerly Op. Cert. Diploma A.A.S.
			Sanitary Landfill Technology	formerly A.A.S.
	TN	Vanderbilt University	Environmental and Water Resources Engineering/ Solid Waste	M.S. M.E. Ph.D.
V	MI	Michigan Technological University	Environmental Engineering	B.S.C.E. B.S.E. M.S.C.E.
VII	IA	University of Iowa	Environmental Engineering	M.S. Ph.D.
	MO	University of Missouri-Rolla	Environmental and Sanitary Engineering	M.S. Ph.D.

As Table 2 indicates, one school (Hofstra University) offers a certificate; one (Temple University), an Associate in Technology; 7 offer bachelors degrees; 13 one or more masters degrees; and 9 offer the Doctor of Philosophy degree. Solid waste courses constitute only a sequence option in the majority of the programs listed; this is a critical point to bear in mind in the interpretation of data in this report.

B. Enrollment Statistics and Graduates

Some caution should be employed in the interpretation of the enrollment statistics depicted in Table 9. The large figures recorded for programs within engineering departments often represent total departmental enrollment and are not, therefore, an accurate reflection of the actual number of students with a concentration or equivalent in the solid waste sequence. Thus, the total solid waste enrollment of 2,418 is an inflated figure which gives the appearance of the area being more dynamic than it is.

Although many people in Phase I stated explicitly that the greatest need for training/education expansion in the solid waste area is at the operator/landfill manager certificate and/or associate level, only two programs in this report are of that type, with a total enrollment of fifty-eight. The two programs at the Wilson County Technical Institute which were designed to address these needs are no longer funcitonal due to lack of student interest and funding support. Until state certification of sanitary operators and/or managers becomes mandatory, more monies are provided to support such efforts, and increased appreciation and social status are accorded to operators, such program efforts will remain minimal.

A total of 1,629 (58%) of the students are enrolled in bachelors programs, 99% full-time; 674 (28%) are seeking masters degrees; more than 58% of these students are full-time; Ph.D. enrollments amount to 57, only 2% of the total.

The following table (Table 3) summarizes the enrollment profiles of the solid waste programs surveyed during Phase II. The reader should keep in mind these points while interpreting the table:

1) These figures do not include all solid waste programs in the country;

2) Cases in which breakdowns between masters and doctoral programs are unavailable within any one program were assumed to be comprised of 90% masters and 10% doctoral candidates;

3) The enrollment change (up/down/stable) indicates apparent enrollment trends over the past three years. Each degree receives one response.

TABLE 3

SOLID WASTE ENROLLMENT PROFILE SUMMARY

(REGIONS I, II, III, IV, V, VII)

Degree	Enrollment Full-time/Part-time			Graduates Average # Per Year	Graduate Change by Program Up / Down / Stable		
Certificate	0		50	50	0	0	1
Associate	8		0	2	0	1	0
Bachelors	1,614		15	369	6	0	2
Masters	305	217[1]	152	183	10	0	13
Doctoral	51	2[1]	4	13	0	1	2
TOTAL[2]	1,978	219	221	617	16	2	18[3]

[1] No breakdown was available as to full-time/part-time distribution.

[2] Enrollments are for programs and are not specific to students pursuing solid waste sequence options.

[3] Not all programs responded to this question.

The preceding table reflects (through the regions represented) the concentration of solid waste programs in the eastern half of the country. However, this should not lead the reader to assume that there are no solid waste programs in the western regions. Forty-five percent of the programs which addressed this question indicated a stable situation; and only six percent (2 programs) indicated a decline. This break out is a reflection of stable or increasing enrollments in engineering programs at a time when higher education as a whole is confronting a stable/declining period of enrollment.

Overall, 90% of the students in programs with solid waste options are full-time. In the one certificate program included, all are part-time students. In the single associate level program, all are full-time. In excess of 99% of the bachelors level students are full-time. At the graduate level, among those programs for which the figures are specific, 93% of the doctoral students are full-time. It is at the masters level that as many as 25% are part-time students. Frequently persons working full-time return to school to obtain a Masters degree.

C. Student Origin

Student origin ratios for the programs in solid waste vary significantly. Foreign enrollment varies from none to a high of 25% in the Yale M.P.H. program. Only four programs responding indicated any foreign student enrollment. Altogether, foreign students account for only one percent of the total; all are at the graduate level. Only one program, Environmental Engineering at Rensselaer Polytechnic Institute (with 20%), has less than 50% in-state enrollment at the undergraduate level. In-state undergraduate enrollments commonly exceed 80% of the total. At the graduate level the proportion of out-of-state students varies from a low of 10% at Clarkson College to a high of 90% at Vanderbilt University.

D. Employment

As indicated in Table 9 under Employment, graduates of most of the programs find employment in the private sector at a rate of sixty to seventy percent. Notable exceptions are graduates of Vanderbilt and West Virginia universities, of whom seventy-five percent are employed by the government; and those of Rensselaer Polytechnic Institute and the University of Pittsburgh, of whom eighty percent are employed in the private sector. Overall, public sector employment is somewhat less likely for persons with undergraduate degrees than for those with graduate degrees.

Graduates of programs for which there is specific information regarding industry versus consulting positions in the private sector fill consulting positions at a rate significantly greater than that for industry. The most notable exception is West Virginia University, whose graduates enter consulting at a rate of ten percent (75% of the total obtain government positions.) Thirty-five to sixty percent of all graduates of most programs become consultants. The majority of these are positions in consulting engineering firms; few of which deal with solid waste.

The following table (Table 4) depicts the overall employment figures for the solid waste programs included in this report.

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TABLE 4

SOLID WASTE EMPLOYMENT

(REGIONS I, II, III, IV, V, VII)

Degree	Private Sector Industry/	Combined*/	Consulting	Government	Other
Certificate	40%			60%	
Associate	40%		40%	20%	
Bachelors	11%	34.5%	15.8%	38.7%	
Masters	28.5%	30.2%	47%	62.3%	
Doctoral	17%	23.5%	22%	37.5%	
Graduate	10%	36%	19%	35%	

*Several programs were unable to separate the private sector employment into the Industry/Consulting categories.

The data in the above table were compiled for each degree level by utilizing the average annual graduates figures within each program, and obtaining employment figures in real numbers. These real numbers for each program were then totaled and reworked into total percentages.

A discussion of specific occupations which graduates of these programs enter, in both the public and private sectors, may be found in ADDITIONAL FINDINGS (E. Environmental Occupations) of this report.

E. Faculty

Most programs with solid waste options included in this report depend wholly or largely upon faculty who are full-time with the program. In three programs (The University of Iowa, Clarkson College, and West Virginia

University) the staffing is fairly evenly divided between full-time program faculty and personnel who are based in other departments. Three programs depend wholly, or nearly so, on other department-based personnel designated as part-time faculty with regard to the solid waste program; these are Hofstra University's certificate program, Environmental Engineering and Science at Drexel University, and Environmental Pollution Control at The Pennsylvania State University.

Overall, of the 240 total faculty members, 116 (48%) are full-time; 124 (52%) are part-time. This ratio is somewhat distorted because the three programs which depend mostly or wholly upon part-time faculty are large programs, faculty-wise, totalling 97 part-time faculty (78% of all part-time faculty). Of the other fifteen programs, only 27 are part-time faculty, representing only 24% of the total faculty of these programs. No meaningful student-faculty ratio can be developed due to the variance in methods of program staffing and because of differences in teaching loads and research commitments. Also, the majority of these faculty members do not teach courses directly related to solid waste management.

F. Internship/Applied Study Terms

Only three programs indicated internships or applied study terms are integral components of the curriculum. These are the M.P.H. degree program in Environmental Health at Yale University, the Environmental Engineering M.S. and Ph.D. degree programs at the University of Iowa, and the B.S. degree portion of the Rensselaer Polytechnic Institute Environmental Engineering program.

G. Graduate Follow-Up

Ten of the eighteen programs responded that graduate follow-up is conducted in one form or another. Most have entry-level data only for the majority of the graduates. In many cases information about graduates beyond the first job accepted is a result of personal contacts maintained between the former student and a faculty member or between a faculty member and an employer.

Follow-up procedures beyond the informal word of mouth consist of program or department mail surveys.

II. ADDITIONAL FINDINGS

A. Recruitment Techniques

The most widespread form of recruitment is by means of distribution of brochures or posters with tear-off cards. Programs at all levels find this to be a most effective method of advertising. It is impossible to determine the percentage of students that actually enroll in a particular program because of exposure to a brochure or poster. However, the majority of the contact people interviewed feel that the response, i.e., students requesting additional information about a program, is quite high.

Admission offices often send a representative to high schools and community colleges in order to recruit students for their institution rather than recruiting for a particular program. It is within the institution that students are recruited for solid waste programs. The image of a program plays a strong role in attracting majors. Word of mouth by students is a very effective method of recruitment.

Recruitment of students for associate and operator certificate programs in solid waste will remain exceedingly difficult as long as mandatory education and/or certification requirements are not imposed and little recognition is accorded to the occupations graduates are prepared to enter.

B. Research Funding and Sources of Student Support

Research funding and student support play a vital role in the quality of education at the majority of institutions visited. Research money comes from a variety of sources, both public and private. Federal agencies such as the Environmental Protection Agency, National Science Foundation, National Institute of Health and the Army Corps of Engineers support a substantial amount of research projects at most major universities. State and municipal agencies also contribute a significant amount of money for research activities at local institutions. Private industry research grants and private consulting contracts generate the majority of funding from the private sector, although private foundations also support a small percentage of research projects. Research support specific to solid waste is not comparable to areas such as air, potable water, and waste water.

Student support includes several sources and types traditionally available to people regardless of major and some which are unique or of more than usual significance to solid waste education.

University-wide scholarships are quite common, as are student loans. Most undergraduate students are employed during the summer and many work during the school year. The work-study program is a common source of income. Research and teaching assistantships are available in most graduate programs. Many student jobs are supported through research funding.

Engineering students are often eligible for a cooperative work program. Many students have industry grant support, often in the form of a traineeship. Many, especially in the associate programs, qualify for Basic Educational Opportunity Grants. Some students receive support from professional societies; some are reimbursed for their education expenses by their employer.

C. Usage of ERIC and IRIS

ERIC and IRIS are federally maintained computer retrieval systems encompassing educational resource materials on a national scale. Since the effectiveness of any such system can best be measured by its application and use, Phase II was appropriately expanded to include an adjunct assessment of the "utilization profile" of the educational community.

It should be pointed out that the respondents to the assessment question, "Have you ever used ERIC or IRIS?", were faculty rather than students, and that the findings contained in Table 5 should be interpreted accordingly.

TABLE 5

ERIC/IRIS UTILIZATION PROFILE - SOLID WASTE

	Yes	No	Total Responding
ERIC	3	24	27
IRIS	3	24	27

It should be noted that many of the "no" responses were followed by a statement or question indicating the respondent did not know one or both of the retrieval systems existed.

Of all the environmental areas surveyed in Phase II (air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy), the following depicts the total number of responses.

TABLE 6

ERIC/IRIS UTILIZATION PROFILE - PHASE II SUMMARY

	Yes	No	Total Responding
ERIC	72	307	379
IRIS	64	314	378

D. Program Flexibility

Phase II researchers, in an effort to compile data relative to the procedural, administrative, and developmental constraints in the modification of curriculum materials, posed the following questions to faculty members that were interviewed: "What is the time required to implement a complete content change in a course?", and "What is the time required to implement a complete change in a program?". For the purposes of this study, a program is considered a course of study, either completely prescribed, or containing options, with an identity of its own and standard rules and procedures, the satisfaction of which leads to a degree, certificate, or diploma. A course is considered a unit of a program, in which a body of knowledge is presented, the satisfactory completion of which leads to the awarding of a predetermined or individually arranged number of credits.

These questions were asked of faculty members in each of the program areas described in this review. It was believed that the compilation of such information could provide useful and informative comparisons by degree level, by geographic location, and by other related variables. It was also thought that this information would provide insights into the flexibility or lack of flexibility in the development and modification of courses and programs. This information holds potential interest to those considering the development of curricula, to those currently offering, but considering the modification of curricula, and to potential funding sources.

The following tables present categorizations of responses to the curriculum flexibility questions. Each responding program has one response recorded for each degree level. The responses are to be considered the best estimates of these faculty members of the time frames required to complete the changes under "normal" conditions.

TABLE 7

TIME REQUIRED TO IMPLEMENT A COMPLETE CONTENT CHANGE IN A COURSE

Degree Program	Less than 1 month	1 month-1 year	more than 1 year; less than 2	2-4 years	more than 4 years	Undetermined
Associate	1					
Bachelors	2	6				
Masters	2	8				
Ph.D.	1	5				
TOTAL	6	19				

Several solid waste programs are able to implement complete content changes in courses immediately. The maximum time required by the programs responding is one year. Most are able to implement changes at the beginning of the first term after change is determined to be desirable.

TABLE 8

TIME REQUIRED TO IMPLEMENT A CHANGE IN A PROGRAM SEQUENCE

Degree Program	Less than 1 month	1 month-1 year	more than 1 year; less than 2	2-4 years	more than 4 years	Undetermined
Associate		1				
Bachelors		6		1		
Masters	1	7				1
Ph.D.		5				1
TOTAL	1	19		1		2

One program is able to implement a change in program sequence and requirements immediately at the masters level. The vast majority are able to do so within one year; usually at the beginning of the term succeeding the determination to make a change. One program indicated that a change at the bachelors level requires three years. One school, with a masters and Ph.D. program indicated that the time factor was variable.

E. Environmental Occupations

Preparation of students for specific occupations or for a general occupational area was discussed during interviews. To verify data and maintain consistency, respondents were mailed occupational check lists specific to their program area(s). They were asked to indicate th[illegible] occupations listed for which their graduates are qualified and to add appropriate occupations not listed. The following is a summary of the results of the occupational component of the study.

Respondents representing programs which offer a Bachelors degree indicated their graduates are prepared for the following occupations:

Environmental Engineer
Landfill Operating Manager
Sanitary Engineer
Sanitary Technician
Solid Waste Management Technician
Environmental Control Technologist
Environmental Health Aide/Technician
Pollution Control Specialist
Sanitarian
Land Use Planner
Environmental Specialist/Solid Waste Management
Sanitary Engineering Technologist
Solid Waste Collection Operator
Solid Waste Systems Manager
Ecologist

Environmental Engineering Technician
Environmental Monitor Specialist
Physical Science Technician
Public Health Sanitarian/Inspector/Engineer

Respondents representing programs which offer graduate degrees indicated most of the same occupations as listed for the bachelors level; no additional occupations were indicated.

In addition to most of the above occupations, persons who complete the certificate program at Hofstra University are qualified as:

- Recycling Operator
- Sanitary Landfill Equipment Operator
- Sanitary Landfill Operator

F. Images of Environmental Programs Within the Institution

The image of these programs within the institution, i.e., among colleagues and students in other programs, is extremely favorable. The programs which are a part or an outgrowth of an established engineering program generally enjoy the same reputation as the parent department. Several respondents referred to their reputation for excellence in scholarly activities, recognized soundness in technical content, solid funding support, and success in attracting superior students.

G. The Need for Additional Curriculum Materials

One respondent stated that much of the available material is outdated; thus much time and effort must be spent preparing appropriate materials for student use. This was not a generally agreed upon point. There was concern expressed as to the need for identification of high quality material (a separation of grain and chaff situation) and a need for a reference which notes textbooks devoted specifically and totally to solid waste management. Some respondents expressed desires for laboratory hardware and computer software for training purposes.

H. Student/Graduate Communication and Management Skills

During Phase I of the National Environmental/Energy Workforce Assessment, researchers noted that a large number of the persons interviewed who employ persons with environmental or energy training/education observed that many graduates are being produced who are deficient in the much-needed communication (oral and written) and financial management skills. During Phase II, faculty of the environmental/energy programs were questioned regarding their own attitudes on this subject in order to ascertain the consistencies or discrepancies in perceptions between academia and prospective employers of graduates.

Respondents in engineering-based programs generally agreed that communication skills are a problem with students entering the programs. A few, however, stressed that this is definitely not true of their students and that strong formal report writing components in several courses give students the opportunity to improve writing skills significantly. Many programs attempt to deal with communication skills development by such means as requiring students to prepare technical reports and participate in oral presentations within specific courses, and by encouraging or requiring the development of a thesis or dissertation. The efforts to enhance student communication skills within engineering programs are often limited. These include: a) communications courses that may be chosen as electives are rarely geared toward the specific needs or purposes of engineering; and b) some engineering programs have been under pressure to reduce the number of credits required for a degree, and as few engineering courses can be deleted, those courses such as technical report writing must often be eliminated from the curriculum.

A similar, though slightly less emphatic, response was elicited from engineering faculty regarding student/graduate financial management skills. Within most engineering departments, courses are available that deal directly and/or indirectly with engineering economy and financial management.

III

A Summary Profile of Representative Educational Programs

The following footnotes (1-6) refer to the various column headings of the Table. Other footnotes are specific to the figures which were provided by various institutions and are used throughout the Table.

[1]Enrollment	1976-77 statistics
[2]Graduates	average for last three years; 'change' indicated apparent trends within that three-year period
[3]Employment	'other' includes positions such as those found within the educational community
[4]Faculty	full-time and part-time is determined by individual institutions
[5]Internship/Applied Study	part of an option to obtain a degree; may or may not have financial reimbursement connected with it
[6]Graduate Follow-up	a standardized procedure that enables the institution to periodically determine the employment of their graduates
NA	Not Applicable/Not Available
*Asterisk	denotes that a program appears in more than one volume of the profile

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

STATE	INSTITUTION	PROGRAM	DEGREE	ENROLLMENT[1]		GRADUATES[2]	
				FULL TIME	PART TIME	No. / YEAR	CHANGE
CT	Yale University	* Environmental Health	M.P.H.	20	0	10	Stable
IA	University of Iowa	* Environmental Engineering	M.S.	27	25	14	Stable
			Ph.D.	5	0	1	Stable
MI	Michigan Technological University	* Environmental Engineering	B.S.C.E.	135	0	25-35	Stable
			B.S.E.				Stable
			M.S.C.E.	18	0	11	Stable
MO	University of Missouri-Rolla	* Environmental & Sanitary Engineering	M.S.	13	45	N/A	N/A
			Ph.D.	1	0	N/A	N/A
NY	Clarkson College	* Civil and Environmental Engineering	B.S.	530	0	120	Up
			M.S.	20	5	12	Up
	Cornell University	* Waste Management Engineering	M.S.	8	0	6	Stable
			M.E.		0		Stable
			M.P.S.		0		Stable
			Ph.D.		0		Stable
	Hofstra University	Solid Waste Management	Cert.	0	50	50	Stable
	Rensselaer Polytechnic Institute	* Environmental Engineering	B.S.	20	0	20	N/A
			M.S.	40	14	20	N/A
			M.E.				N/A
			Ph.D.	N/A	N/A	3	N/A

* Enrollment figures are those for the entire program and are not specific to persons involved in a solid waste sequence.

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SOLID WASTE EDUCATIONAL PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	PRIVATE SECTOR									
	INDUSTRY	CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
25/50/25	50%		50%		10	0	X		X	
75/20/5	15%	50%	35%		6	5	X		X	
75/20/5	15%	50%	35%				X		X	
87/13/NA	25%	35%	40%		4	0		X	X	
87/13/NA	25%	35%	40%					X	X	
87/13/NA	25%	35%	40%					X	X	
NA/NA/NA	50%		50%		.7	0		X		X
NA/NA/NA	50%		50%					X		X
90/10/NA	60%		40%		21	1		X	X	
90/10/NA	60%		40%					X	X	
NA/NA/NA	25%	50%	25%		4	6		X		X
NA/NA/NA	25%	50%	25%					X		X
NA/NA/NA	25%	50%	25%					X		X
NA/NA/NA		25%	25%	50%				X		X
85/15/NA	40%		60%		2	20		X		X
20/80/NA	20%	60%	20%		11	0	X			X
20/80/NA	20%	60%	20%					X		X
20/80/NA	20%	60%	20%					X		X
NA/NA/NA	N/A	N/A	N/A					X		X

TABLE

A SUMMARY PROFILE OF REPRESENTATIVE

STATE	INSTITUTION	PROGRAM	DEGREE	ENROLLMENT[1] FULL TIME	ENROLLMENT[1] PART TIME	GRADUATES[2] No. / YEAR	GRADUATES[2] CHANGE
PA	Carnegie-Mellon University Carnegie Institute of Technology	Environmental Engineering	B.S.	120	N/A	34	Up
			M.S.	20	N/A	19	Up
			M.E.		N/A		Up
			Ph.D.	8	N/A	2	Stable
	Drexel University	Environmental Engineering & Science	M.S.E.E.	69	36	15	Up
			M.S.E.S.				Up
			Ph.D.			4	Stable
	Temple University	Environmental Technology	A.T.	8	0	2	Down
		Environmental Engineering Technology	B.S.	64	12	15	Up
	The Pennsylvania State University	Environmental Engineering	B.S.	127	3	23	Up
			M.S.	19	0	8	Up
			M.E.		0		Up
			Ph.D.		0		Up
		Environmental Pollution Control	M.S.	25	1	14	Stable
			M.E.P.C.				Stable
			M.E.				Stable
		Environmental Resource Management	B.S.	583	0	110	Up
	University of Pittsburgh	Environmental & Sanitary Engineering	B.S.	35	0	12	Up
			M.S.	30	30	35	Up
			Ph.D.	20	N/A	4	Stable
TN	Vanderbilt University	Environmental and Water Resources Engineering/Solid Waste	M.S.	16	0	6	Stable
			M.E.	6	0	2	Up
			Ph.D.	10	0	2	Down
WV	West Virginia University	Environmental Engineering	M.S.C.E.	200		10	Stable
			M.S.E.				

9

SOLID WASTE EDUCATIONAL PROGRAMS

STUDENT ORIGIN IN-STATE/ OUT-OF-STATE/ FOREIGN (%)	EMPLOYMENT									
	PRIVATE SECTOR				FACULTY[4]		INTERNSHIP/[5] APPLIED STUDY		GRADUATE[6] FOLLOW-UP	
	INDUSTRY	CONSULTING	GOV'T	OTHER[3]	FULL TIME	PART TIME	YES	NO	YES	NO
50/50/NA	40%	30%	30%		11	2		X	X	
25/62/13	40%	30%	30%					X	X	
25/62/13	40%	30%	30%					X	X	
25/62/13	40%	30%	30%					X	X	
50/50/NA	60%		40%		0	37		X		X
50/50/NA	60%		40%					X		X
50/50/NA	60%		40%					X		X
80/20/NA	40%	40%	20%		2	N/A	X		X	
80/20/NA	40%	40%	20%			N/A	X		X	
90/10/NA	25%	45%	30%		10	N/A	X			X
50/50/NA	25%	45%	30%		6	N/A		X		X
50/50/NA	25%	45%	30%			N/A		X		X
50/50/NA	25%	45%	30%			N/A		X		X
50/50/NA	50%		30%	20%	N/A	40		X	X	
50/50/NA	50%		30%	20%	N/A			X	X	
50/50/NA	50%		30%	20%	N/A			X	X	
95/5/NA	50%		50%		1	10	X		X	
95/5/NA	30%	50%	20%		8	0		X	X	
60/20/20	30%	50%	20%					X	X	
60/20/20	30%	50%	20%					X	X	
10/90/NA	25%		75%		8	0		X		X
10/90/NA	25%		75%					X		X
10/90/NA	25%		75%					X		X
NA/NA/NA	15%	10%	75%		5	3		X		X
NA/NA/NA	15%	10%	75%					X		X

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Michigan Technological
University Catalog 1975-76

PROJECT COMMENTARY

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Columbia Bulletin 1977

PROJECT CONSTRAINTS

In preparation for the on-site interviews, all of the institutions' catalogs were intensively reviewed in order to determine where environmental programs were being offered. During the course of this study, 171 institutions were visited and a total of 338 environmental programs, representing 45 states and Washington, D.C., were surveyed in detail. Albeit significant, these programs represent only a portion of all such programs available and cannot be construed as an in-depth survey of all environmental programs. It is, however, a representative sample within each of the environmental pollution control areas of Air, Noise, Pesticides, Radiation, Water and Wastewater, Solid Waste and Energy.

Several constraining factors to the proposed comprehensiveness of the study were encountered while collecting data from the institutions. It was disappointing to find that definitive records or statistics were generally unavailable which would describe specifically the placement of environmental program graduates. General indications of placement within categories, such as government or industry, were often available in percentages only. Depending on the size of the program and its age, some contact people could describe all graduates, others knew only where the past year's graduates were presently employed, and still others were aware only of their advisees entry-level positions and subsequent moves.

It also became clear during the on-site interviews that some programs of similar or identical content had different titles. This lack of clarity within the environmental areas serves to confuse the casual reader. For that reason, attention must be directed to the actual environmental course listings included in each program summary.

A list of terms commonly used during the on-site interviews and subsequently in this report was developed in order to facilitate precise data gathering. The reader is directed to Appendix II, TERMINOLOGY.

No attempt was made, in this report, to qualitatively judge any of these programs. The apparent absence of substantial qualitative measures in the environmental education field in general and the desire to collect data in a neutral atmosphere underscore the reasons for this omission. It appears that there is a need for the development of an environmental program model in each of these areas in order that some qualitative standards be provided where none now exist.

PROJECT COMMENTARY

The solid waste educational programs discussed in this report are not as varied in content or approach as is typical of other environmental education areas. Most are of a highly technical, engineering based nature.

Enrollments in the programs included are steady or growing slowly (the sub-baccalaureate level is an exception). Employment opportunities for graduates are reasonably good; most find jobs in private consulting firms or in government. Research funding is an area of concern to several programs, both in the sense that it is deemed less than adequate now and that it may be reduced in the future.

Generally, the remarks elicited of faculty during Phase II interviews regarding current conditions and the future of solid waste educational programs project an atmosphere of guarded optimism. Programs were nearly equally divided between those who said enrollments will continue to increase, but at a reduced rate, and those who think enrollments have topped out and will remain steady or decline, somewhat.

Two related factors appear to underlie the latter opinion: a less-than-anticipated growth rate in solid waste management jobs; and an increased emphasis at the federal governmental level upon energy related activity, often, it is felt, at the expense of environmental areas such as solid waste. Research funding is not as great as was expected at the time of the enactment of the Resource Conservation and Recovery Act of 1976.

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The above comments and conclusions are, it should be recalled, those of persons teaching in baccalaureate and graduate programs. Solid waste training/education efforts at the certification and associate levels for personnel below the middle management level, or not involved in research activity, are confronted with the duel problem of little or no funding support and little incentive ot potential students to enroll.

Education efforts in solid waste management are top heavy. This is not to say that too many people are being trained in graduate programs, simply that too few are trained to function efficiently and responsibly at the operator level. Until mandatory operator certification is recognized as desirable and becomes widespread, and unless funding support becomes readily available, and until the social status of solid waste management personnel is increased, no improvement in this situation can be expected.

Resource recovery and waste-based power generation are receiving increasing attention in solid waste management programs, but not to the degree anticipated by many as little as two years ago. Again, lack of funding is most often cited as the controlling factor.

Overall, the future of solid waste educational programs and the employment opportunities available to graduates is not as assured as those of other pollution control areas. This is not because solid waste is less problematic than in previous years, but due to emphasis, in terms of interest, perceived needs, and dollar allocation, being shifted to other areas, particularly energy.

LIST OF SOLID WASTE TRAINING INSTITUTIONS BY DEGREE

Photo reprinted from the Northland College Catalog 1975-1976

LIST OF SOLID WASTE TRAINING INSTITUTIONS BY DEGREE

CERTIFICATE

Hofstra University

MASTERS

West Virginia University
Yale University

MULTIPLE DEGREES OFFERED BY ONE INSTITUTION

Certificate/Associate
  Wilson County Technological Institute

Associate/Bachelors
  Temple University

Bachelors/Masters
  Clarkson College
  Michigan Technological University

Bachelors/Masters/Doctoral
  Carnegie-Mellon University
  Rensselaer Polytechnic Institute
  The Pennsylvania State University
  University of Pittsburgh

Masters/Doctoral
  Cornell University
  Drexel University
  University of Iowa
  University of Missouri-Rolla
  Vanderbilt University

SOLID WASTE TRAINING SUMMARIES

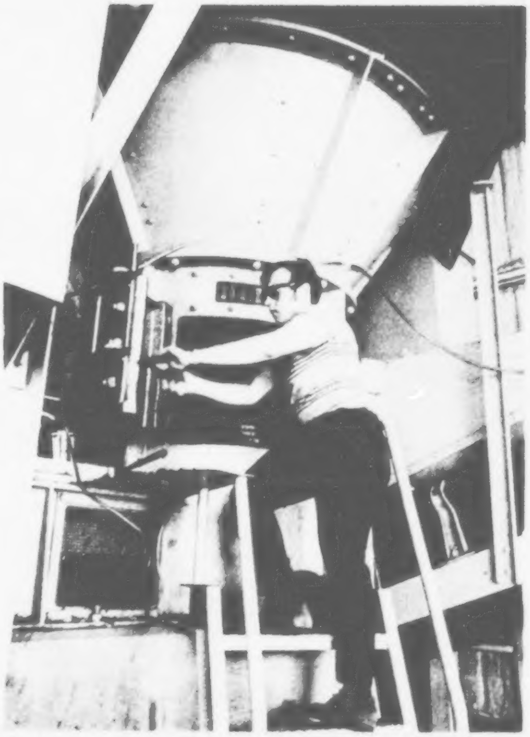

Photo reprinted from the 1976-77 Annual Report, Engineering Experiment Station, College of Engineering, University of Wisconsin, Madison

SOLID WASTE TRAINING SUMMARIES

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INSTITUTION: CARNEGIE-MELLON UNIVERSITY
CARNEGIE INSTITUTE OF TECHNOLOGY

PROGRAM: Environmental Engineering

DEPARTMENT: Civil Engineering

DEGREE: Bachelor of Science (B.S.), Master of Science (M.S.), Master of Engineering (M.E.), Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Francis Clay McMichael
Head, Department of Civil Engineering
Carnegie-Mellon University
Carnegie Institute of Technology
5000 Forbes Avenue
Pittsburgh, Pennsylvania 15213
(412) 621-2600

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Environmental engineering is not emphasized as a formal program at the Carnegie Institute of Technology. Emphasis is placed on research on environmental topics which is mainly conducted by departments of the College of Engineering. The principal areas of research are air pollution, industrial wastewater, solid waste management and energy. The prinicpal degree granting departments in the College conducting environmental research are the Chemical, Civil, Mechanical and Engineering and Public Policy Departments. The Engineering and Public Policy Department is also part of the Graduate School of Urban and Public Affairs. All of these departments are involved in undergraduate projects and graduate thesis research in the field of environmental engineering.

Selected institutes or research programs of the Carnegie Institute of Technology which are involved in environmental engineering are the Environmental Studies Institute (to be renamed the Center for Energy and Environmental Studies) which grants an M.E. in Environmental Studies, and the Division of Nuclear Science and Engineering.

The Department of Civil Engineering offers a graduate study option in Environmental Engineering. Emphasis is on water and wastewater treatment and management, and students receive a sound understanding of water science and water process technology. The Department cooperates with other departments and colleges within Carnegie-Mellon University to sponsor interdisciplinary programs leading to special degrees or joint degrees, Research facilities for use of students in the program include an Environmental Engineering Laboratory for research mainly in the areas of water and wastewater chemistry. A unit operation laboratory is also utilized for both teaching and research. A clean laboratory is presently under construction for aerosol studies. Analytical facilities are available to measure common inorganic and organic indices of water quality.

PROGRAM REQUIREMENTS

The Department of Civil Engineering offers a variety of degrees at the Master's level. They include: M.S. in Civil Engineering; M.S. in Civil Engineering/Engineering and Public Policy; and Master of Engineering. The Master of Science degree requires a minimum of 96 academic units consisting of:

(1) at least 36 units of graduate courses in Civil Engineering;
(2) a minimum of 24 (a maximum of 42) units of graduate project,
(3) other approved courses as suggested by the faculty advisor, and;
(4) satisfactory completion of either a comprehensive final examination or an M.S. thesis.

The Department's Master of Engineering degree normally requires a minimum of 192 units of work with strong emphasis on interdisciplinary project work. Students register in an enigneering department but select problems drawn from areas such as the environment. Ph.D. cnadidates complete an additional two years of graduate study beyond the M.S. degree. A qualifying examination and final examination are required, but no foreign language is required. There is a one-year residence requirement for the Ph.D.

Research assistantships, teaching assistantships and fellowships are offered to graduate students as financial aid. A much greater number of assistantships is available in comparison with the number of fellowships. Graduate assistantships are usually one-third time appointments requiring 12 hours of work for the Department weekly.

CURRENT FACULTY, STUDENTS, GRADUATES

The College of Engineering faculty, totaling about 90, teach both undergraduate and graduate students. The faculty devote about 67 percent of their time to teaching and 33 percent to research activities. The Civil Engineering faculty is composed of thirteen members, of whom six are full professors. Three professors have research interests in environmental engineering areas.

During 1977, the College of Engineering had research expenditures totalling about $6 million, of that amount, $3 million was for energy research, and one-third of the energy expenditures ($1 million) was for environmental-energy research. The main funding source is the National Science Foundation, and ten percent is provided by industry.

The College of Engineering has a total undergraduate enrollment of 1,200 students, most of which are full-time. Approximately 90 percent are male. There are about 400 graduate students (5% female) and approximately 40 are part-time. It is estimated that 350 stu dents annually complete the baccalaureate requirements and 100 students earn advanced engineering degrees. In Civil Engineering, twenty students were enrolled in the Master's programs in the fall of 1976, and eight students were enrolled in the Ph.D. program. During the 1975-76 school year, 34 students earned undergraduate degrees, 19 earned Master's degrees and two students received the Ph.D.

Approximately twenty percent of the students receiving B.S. degrees continue directly to graduate schools. It is expected that all graduates obtain employment directly in their field and 70 percent obtain positions in the private sector. Although the university maintains a Placement Office, students are also very successful in obtaining employment through individual contacts.

PROGRAM PROJECTIONS

Emphasis in the environmental engineering program in future years will remain on industry and the attempt to solve environmental and energy, fuel substitution, solar energy, and increased coal use problems. The Civil Engineering Department has no intention of developing a separate undergraduate major in environmental engineering. No change is foreseen in the institutional arrangements for degrees, but an increased emphasis on energy/environmental problems is expected. One additional faculty member was recently added to the environmental engineering program in the Civil Engineering Department. He has a doctorate, and his research interests include air pollution, and specifically, in trace metals in aerosols.

COURSE DESCRIPTIONS

12-721 Dynamic Hydrology - A theoretical basis is provided for analyzing water movement within the hydrology cycle; survey of important principles used in the analysis of ground water flow with applications to basin-wide ground water management; the design of industrial and domestic land and deep well waste disposal systems and to the prevention of water problems in coal mining operations; and other topics. (9 s.h.)

12-722 Wastewater Treatment: Theory and Design - Theory and design of wastewater treatment unit operations including sedimentation, activated sludge, and biological filtration. Material covered includes biological process kinetics, and theory and practice of advanced wastewater treatment processes. The design of solid handling systems focuses on thickening, digestion, incineration, and terminal disposal facilities. Laboratory sessions illustrate chemical principles of dilute aqueous systems and provide familiarity with chemical measurements commonly used in water and wastewater engineering. (9 s.h.)

12-723 Water Resources Chemistry - A rigorous yet practical basis for applying the principles of chemical equilibrium and kinetic models and physical chemistry to a description of the composition of waters and to water and wastewater treatment processes. Laboratory sessions illustrate chemical principles of dilute aqueous systems and provide familiarity with chemicals measurements commonly used in water and wastewater engineering. (9 s.h.)

12-732 Special Topics in Environmental Engineering - Development and application of models for assessing environmental problems with an emphasis on air pollution. Both elementary and more advanced models will be discussed. Consideration will be given to causes and effects of air pollution, control technologies, energy consumption rates and costs, and the need for efficient data collection and management. The course also includes studies of modeling atmospheric transport of air pollutants from source to sink. Offered from time to time as demand warrants. (9 s.h.)

INSTITUTION: CLARKSON COLLEGE

PROGRAM: Civil and Environmental Engineering

DEPARTMENT: Civil and Environmental Engineering

DEGREE: Bachelor of Science (B.S.); Master of Science (M.S.)
(in Civil and Environmental Engineering)

CONTACT: Dr. Norbert L. Ackerman
Chairman, Department of Civil and Environmental Engineering
Clarkson College
Potsdam, New York 13676
(315) 268-6529

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The undergraduate curriculum at Clarkson College in Civil and Environmental Engineering is designed to provide an understanding of the fundamental principles of mathematics, mechanics, science, and humanities on which engineering is based. During the junior and senior years the program concentrates on various subjects in the field of civil and environmental engineering and through the selection of electives, proficiency can be developed in particular areas of interest. Elective concentrations include the areas of environmental engineering and water resources engineering.

The Civil and Environmental Engineering Department also offers a graduate program in Water Resources and Environmental Engineering. Bachelor of Professional Studies, Master of Engineering and Doctor of Philosophy (Engineering Science) degrees are also available to students enrolled in the department. The majority of the graduates enter professional practice in the fields of civil and environmental engineering.

PROGRAM REQUIREMENTS

Undergraduate applicants are required to complete sixteen units of secondary school, including the following ten academic units for admission to the School of Engineering: four units of English; four units of mathematics; and two units of science (one unit each of chemistry and physics). Admission to the graduate program is granted to applicants with an accredited baccalaureate degree in civil engineering and exceptional students with bachelor's degrees in other engineering disciplines will be considered.

Candidates for the baccalaureate degree must complete a minimum of 120 credit hours, complete the physical education or military science requirement, and achieve a minimum cumulative grade point average of 1.850. A minimum of thirty credit hours is required for the master's degree and at least twenty hours must be earned in residence. No foreign language requirement exists for this degree. A thesis and a non-thesis option is available. Thesis credit accepted towards the degree cannot exceed ten hours of credit. Fellowships and assistantships are available to graduate students enrolled in the department. Many New York state residents are eligible for the Tuition Assistance Program which provides $100 to $1,500 per year.

CURRENT FACULTY, STUDENTS, GRADUATES

A total of twenty-two faculty members contribute to the teaching of the department's curriculum. Twenty-one faculty are full-time. Research funding is provided from engineering foundations, private corporations, the U.S. Environmental Protection Agency, and the National Science Foundation.

There are currently (spring, 1978) an estimated total of 530 full-time students enrolled in the Department of Civil and Environmental Engineering (30 female). All students take at least one course in environmental engineering and approximately 20 to 30 percent (133 students) take two or more courses in this area. Enrollment has been consistently growing in the Department of Civil and Environmental Engineering and environmental engineering is considered to be a strong growth area. There are 25 students enrolled in the master's program, and approximately five are part-time.

At the baccalaureate level, there is an average of 120 students who annually receive the B.S. degree. Approximately eleven students annually receive the Master of Science degree. Of about twenty graduate students enrolled in the M.S. degree programs at any one time, twelve will graduate, six will drop out, and six will be enrolled as part-time students and take two to three years to complete the degree requirements.

It is estimated that 93 percent find employment that is directly related to their training, 4 percent in a related field and 3 percent find totally unrelated employment. The college's placement office is considered to have an excellent placement record. Placement statistics for 1975 and 1976 of Clarkson graduates show that over 77 percent were placed within three months of graduation. This includes 55 percent employed, 20 percent enrolled in graduate school, 2 percent engaged in military service, and 21 percent unreported. Of Civil and Environmental Engineering Department graduates, about 60 percent find private sector jobs and 40 percent find government positions.

PROGRAM PROJECTIONS

No changes in faculty staff or program structure are contemplated. No different degree programs are likely to be developed in the School of Engineering, as the college is at staffing and enrollment capacity.

COURSE DESCRIPTION (SELECTED)

Undergraduate courses:

CE 380 Environmental Engineering - An introduction to environmental engineering and environmental quality management. (3 s.h.)

CE 403 Civil Engineering Laboratory - A set of prescribed experiments is required related to the areas of mechanics, hydraulics, soils, materials and environmental engineering. (3 s.h.)

CE 479 Industrial Water Quality Management - A study of water supply and waste disposal problems of industry including technical and regulatory aspects. The nature of industrial wastes. Methodologies of industry waste surveys. (3 s.h.)

CE 484 Solid Wastes Engineering - The study of the principles of the collection, handling and disposal of municipal wastes, and disposal techniques including burial, composting, combustion, size reduction and densification. (3 s.h.)

CE 495 Special Projects in Civil and Environmental Engineering - An individual project is undertaken by the student under the guidance of a staff member. A complete report is required. (3 s.h.)

Advanced undergraduate and graduate courses:

CE 514 Groundwater and Seepage - Principles of confined and unconfined groundwater flow. Analysis by conformal mapping and graphical methods to determine the quantity of seepage, uplift pressures, and exit gradients. (3 s.h.)

CE 571 Water Resources - Consideration of physical, climatic, and economic geography; resources inventories; natural resource systems; conservation concepts; water supply and demand; economic, social and engineering objectives; water law, federal law, agencies, authorities and commissions; general principles of multiple-purpose regional planning; and other topics. (3 s.h.)

Graduate courses:

CE 671 Systems Design in Water Resources Development - Identification of design objectives in water resource development; system characteristics of a river basin; mathematical synthesis of hydrologic data; simulation and optimization; application to a multipurpose river basin system design. (3 s.h.)

CE 681 Water Renovation Processes I - The theory of the chemical-physical processes employed in water and waste treatment technology. The laboratory stresses pilot plant experimentation with emphasis on process design. (3 s.h.)

CE 686 Environmental Facilities Design - Emphasis will be on water supply, waste conveyance, and treatment facilities design. Topics to be covered will include water distribution system design, sanitary sewer system design, water treatment plant design, and waste treatment plant design. (3 s.h.)

CE 698 Graduate Thesis or Special Projects - Analytical or experimental studies under the direction of a faculty member specially designated. A grade and/or credit for this work presented in satisfaction of the requirements for a degree is given when those requirements are completed. (1-10 s.h.)

INSTITUTION: CORNELL UNIVERSITY

PROGRAM: Waste Management Engineering

DEPARTMENT: College of Agriculture and Life Sciences

DEGREE: Master of Science (M.S.)
Master of Engineering (M. Eng.)
Master of Professional Studies (M.P.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Raymond C. Loehr
Director, Environmental Studies Program
New York State College of Agriculture
and Life Sciences
Cornell University
Ithaca, New York 14853
(607) 256-2008

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Waste Management Engineering began in 1969 with initial emphasis on animal waste management. This has expanded to now include agricultural waste management, rural environmental engineering, nonpoint source pollution control, and land application of wastes.

This program is based in the College of Agriculture and Life Sciences. Four degrees are awarded, including the M. Eng. and M.P.S. which are professional degrees, emphasizing advanced work and project development. The M.S. and Ph.D. degrees however, emphasize original research and presentation of a thesis.

Facilities used in support of the program include several waste management laboratories, a pilot plant, large scale university and field facilities and the central computing system of the university.

PROGRAM REQUIREMENTS

Admission to the M. Eng. program requires that a student have a bachelor's degree from an accredited engineering program or its equivalent in an appropriate area of engineering or science. The M.S., M.P.S. and Ph.D. programs require applicants to hold baccalaureate or equivalent degrees from a college or university of recognized standing.

Requirements for the M. Eng. and M.P.S. degrees include thirty credit hours of graduate course work, of which six hours must consist of an engineering design experience involving individual effort and a formal report. No thesis is required. Program flexibility allows students to take courses of interest in a variety of subjects related to environmental and agricultural engineering.

The M.S. and Ph.D. programs are both extremely flexible in course requirements, allowing the individual student to choose his/her Special Committee, a faculty group which becomes solely responsible for his curriculum and research program. Original research and a thesis are required for either degree, M.S. students must take waste management as their major subject and select one minor subject from outside this area of specialization. The Ph.D. requires one major area of specialization and two minors, at least one of which must be in an engineering, agricultural, or basic science subject outside the field of specialization.

CURRENT FACULTY, STUDENTS, GRADUATES

The program faculty consists of four full-time and six part-time members, all of whom spend approximately one-half time teaching and one-half time in research. The program is the recipient of several sources of research funding, including EPA, the federal Departments of Energy and Interior, the National Science Foundation, the Rockefeller Foundation, and local farmer co-ops.

A total of eight full-time students are currently in the program, most of whom are from out of state. Students are recruited through faculty contacts at other institutions, brochures, and ads in professional journals. Most students are receiving some form of financial assistance, primarily research assistantships. Officials indicated that until three years ago, 80 percent of the students were supported by training grants and over a dozen full-time students were in the program.

An average of six students per year graduate from the program and this number is expected to remain constant. Only a small percentage of graduates continue on in school. Most graduates go directly into the workforce and have little difficulty finding jobs in their field, both in the public and private sectors. Generally, students are referred to jobs through faculty contacts.

PROGRAM PROJECTIONS

The program is not expected to increase in the near future. Capabilities exist for expansion, but officials indicated that increased financial support for students would be needed for expansion.

ADDITIONAL INFORMATION

Program officials conduct an annual waste management conference for officials of industry and government, and have developed a modular learning program in Land Application of Wastes to be offered in 1978.

COURSE DESCRIPTION (SELECTED)

471 Soil and Water Engineering - The application of engineering principles to problems of soil and water management. Design and construction of drainage, irrigation and erosion control systems, small reservoirs, and earth embankments. (3 s.h.)

475 Systems Models for Environmental Quality - Introduction to systems analysis techniques and their application to environmental quality management. (3 s.h.)

482 Environmental Control for Animals and Plants - Study of thermal interchanges between animals, including man, and plants with the environment. Understanding of physiological principles affecting thermal comfort and health. (3 s.h.)

675 Solid Waste Management - Study of municipal, industrial, and agricultural solid wastes. Emphasis on waste characteristics, method of treatment and disposal, and interrelationship with air, water, and land environment. (3 s.h.)

676 Industrial Waste Management - Legal aspects, assimilatory capacity of receiving water, joint industrial-municipal collection of wastes, and sewerage service charges. (3 s.h.)

677 Treatment and Disposal of Agricultural Wastes - Emphasis is on the causes of agricultural waste problems and on the fundamentals and application of possible treatment and disposal practices to control the problems. The course is aimed at having the students understand how to make decisions about selecting and utilizing appropriate agricultural waste management processes and systems, as well as how to design and operate the systems. (3 s.h.)

678 Environmental Quality Management for Agro-Ecosystems - The application of systems analysis and mathematics ecology to problems in ecosystem management and environment quality. (3 s.h.)

679 Use of Land for Waste Treatment and Disposal - The socio-legal-technical factors that dictate that disposal of wastes on land be a major alternative in all waste management schemes. (3 s.h.)

771 Soils and Water Engineering Seminar - Study and discussion of the management of agricultural waste, with emphasis on the physical, chemical, biological, economic, and aesthetic requirements. (1-3 s.h.)

INSTITUTION: DREXEL UNIVERSITY

PROGRAM: Environmental Engineering and Science

DEPARTMENT: Multidisciplinary Institute for Environmental Studies

DEGREE: Master of Science in Environmental Engineering (M.S.E.E.)
Master of Science in Environmental Science (M.S.E.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. P. W. Purdom
Director of Environmental Engineering and Science Program
Institute for Environmental Studies
Drexel University
Philadelphia, Pennsylvania 19104
(215) 895-2265

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Initiated in 1963, the graduate program in Environmental Engineering and Science is offered by the Institute for Environmental Studies. The departments of physical sciences, engineering, and life and social sciences cooperate in this multidisciplinary program. The following areas of concentration are offered: Environmental Health; Environmental Planning and Management, Air Resources, Occupational Health; Water Quality and Resources; Solid Wastes; Environmental Assessment; and Environmental Chemistry. Other tracts of study may be developed where the preceding do not meet the student's needs.

Faculty and students utilize research facilities in various colleges for their work in environmental programs. The program's own laboratories include solid wastes, water and wastewater treatment, toxicology, environmental chemistry, and environmental rooms for the study of human behavior and reaction. Small incinerator studies using air flow equipment contained in a large incinerator room are conducted. An environmental library is located at Drexel's library and students have access to computer based abstract services (plotting facilities) and computer terminals. Much research is conducted in collaboration with government agencies and industries in the field. An example is a re-oxygenation study currently being conducted at a dam site in Georgia by a Drexel professor.

PROGRAM REQUIREMENTS

In order to enter this program a strong background in science and mathematics is necessary and applicants are requested to have at least two terms of college chemistry and differential and integral calculus. Students with this background are welcomed from all engineering fields, physical, life, and the social sciences.

The Master of Science in Environmental Engineering is awarded to students holding a Bachelor of Science degree from a curriculum accredited by the Engineer's Council for Professional Development. The Master of Science in Environmental Science is awarded to students possessing a Bachelor of Science degree. All Master's degree applicants complete 48 quarter-credits of course work and full-time students generally require 12 months to complete the program. All students also must complete a project of thesis of six to nine credits. Ph.D. students have a prepared individual course plan which is reviewed by a faculty committee which also administers a candidacy examination. After passing the candidacy examination, the student's research is supervised by a special faculty committee of at least five persons.

Most of the financial assistance provided to graduate students in the program consists of direct grants and fellowships. Drexel awards 15 traineeships supported by the U.S. Department of Health, Education and Welfare. The university supports one teaching assistantship and four to six students with research positions. One laboratory technician is hired by the program. The City of Philadelphia supports three students on a part-time basis.

Many part-time students receive tuition compensation from their employers in industry or government to attend night classes. Most industries in the area do not provide time off during the day to enable their employees to attend day classes so classes are rotated in the evenings.

CURRENT FACULTY, STUDENTS, GRADUATES

Thirty-seven faculty members participate in the teaching of the program's curriculum. Only ten to twenty percent of the staff do not participate in research activities and all faculty are required to teach. Faculty are involved in a broad range of basic and applied research in the following areas: Air Pollution and Air Resources; Water Quality and Water Resources; Solid Wastes; Ecology; Toxicology and Environmental Chemistry; and Environmental Management.

A total of 105 students are enrolled in the program during the fall quarter of 1977 and 69 are part-time(including Master's and Ph.D.). Fourteen students are conducting post-master's work and five passed their candidacy exams to begin work on their doctorates. Two female students are working on post-masters research; four to six are in the M.S. program and one is enrolled in the doctorate program.

During 1976, fifteen students earned the M.S. degree, twelve earned the M.S. in Environmental Science, and four received doctorates. Approximately ten percent of the program's graduates continue on for further education and less than ten percent of those continuing stay at Drexel University. One to two annually attend medical schools, a few go to Schools of Public Health (Michigan, Harvard, North Carolina, Florida) and others go on to various universities, such as, Stanford and the University of Illinois for advanced degrees. Virtually all graduates obtain employment directly in their field and it is estimated that 60 percent obtain private sector jobs and 40 percent find government positions. Most Ph.D.s obtain positions conducting research for industry or private research firms and few with doctorates work for government agencies.

PROGRAM PROJECTIONS

Enrollment has remained stable, although a slight decline has been detected by program officials. Most part-time students are enrolled in water pollution courses. Solid waste courses are now offered every other year. These courses have not been developed as a full-time program. The air pollution specialty may have to be dropped as a specialty area if the number of students enrolled in this area does not increase.

Most faculty additions are expected to result mainly from replacing staff members who have left. Recently, a civil engineer was recruited with an air pollution control engineering background. Two other replacements are foreseen and one, a civil engineer, has a water quality engineering background and the other, a toxicologist, will be recruited by the Biological Sciences Department to teach Biochemistry courses.

Expansion of the program depends on the needs of cities and industry for short course in-service training. If expansion does become necessary it will probably be in the areas of toxic and hazardous substances which are big health problems. Thirty or more students are enrolled in the occupational health specialty area without training grants as they perceive this as an area requiring future trained specialists.

COURSE DESCRIPTION (SELECTED)

F 202 Environmental Chemistry - Principles of physical and organic chemistry applicable to the study and evaluation of environmental conditions, especially the pollution of air, water, and soil. (3 q.h.)

F 208 Fate of Pollutants in the Air and Water Environment - The physical and chemical mechanisms that define the fate of a pollutant are theoretically delineated and applied to model environmental systems. (3 q.h.)

F 209 Advanced Environmental Chemistry - Thermodynamic and kinetic principles and their application to the study of chemical changes and reactions in the water or air environments. (3 q.h.)

F 214 Environmental Physiology - Effects of air pollutants, water pollutants and general environmental factors such as heat, light, sound, stress and activity upon the functions of the human respiratory, nervous, blood and excretory systems. (3 q.h.)

F 221 Environmental Health - Evaluation of environmental hazards, design of environmental controls for the health and well-being of man. (3 q.h.)

F 222 Epidemiology - Principles, purposes and methods of epidemiology; application of methods for the investigation of problems in the field of human diseases, infectious and non-infectious, emphasizing the relationship and equilibrium of host and environmental factors. (3 q.h.)

F 239 Toxicology - Acute and chronic effects of toxic substances and residues. Environmental exposures and controls. (3 q.h.)

F 241 Air Pollution Control Processes - Detailed study of the design and operation of air pollution control processes: settling filtration, inertial separation, scrubbing and precipitation. (3 q.h.)

F 243 Air Pollution Sources - Sources of air pollution will be considered in depth. (3 q.h.)

F 244 Air Resource Management - Component parts of air pollution control programs: air pollution standards, background survey, elements of air pollution control laws, misdemeanor and injunctive surveys, socio-economic surveys, and operation of an air resource management program. (3 q.h.)

F 252 Water Quality Control Laboratory - Analytical procedures used in the assessment of water quality as applied to the analysis of natural waters and to the control of water and waste water treatment processes. (3 q.h.)

F 255 Stream Analysis and Pollution Control - Fundamentals of limnology. (3 q.h.)

F 270 Solid Wastes Systems - An analysis of the public health, economic and political aspects in the operation and design of storage, collection and disposal of solid waste materials. (3 q.h.)

F 279 Environmental Project Analysis - Candidates for the master's degree in Environmental Science, or Environmental Engineering, are required to select an appropriate problem, formulate an approach to its solution, and then test this solution in so far as it is practical. (3 q.h.)

F 291 Research Methods - Introduction to research methods and literature, procedures for the collection and analysis of data; preparation of technical papers. (3 q.h.)

F 298 Thesis - Each student working on a dissertation will file a written report each quarter with his supervisory committee. A copy of this report must be filed with the Program Graduate Student Advisor. (2-12 q.h./term)

INSTITUTION: HOFSTRA UNIVERSITY

PROGRAM: Solid Waste Management
DEPARTMENT: Continuing Engineering Education
DEGREE: Certificate

CONTACT: Dr. Ronald J. Alvarez
Director, Continuing Engineering Education
Hofstra University
Hempstead, New York 11550
(516) 560-3377

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Solid Waste Management is a continuing education program designed to upgrade the skills of personnel working in the field and provide information and training in new and developing technologies. This program, which is sponsored by the U.S. EPA and the New York Department of Environmental Conservation, began at Hofstra in 1970.

The program consists of four separate courses, covering the areas of incineratory technology, sanitary landfill, and resource recovery. Continuing education units are awarded for the completion of each course and the certificate is awarded upon completion of the program.

Courses are taught by personnel of the Continuing Education Division at Hofstra as well as other professionals in the field of solid waste management and resource recovery. Classes are supplemented by tours of solid waste facilities and landfills.

PROGRAM REQUIREMENTS

Because this is a continuing education program, there are no admission requirements.

Each course in the program is offered on an intensive study basis. The incinerator technology and sanitary landfill courses are each five-day, thirty hour courses. Completion of each course earns three continuing education units. The resource recovery course is three days in length and earns one and eight-tenths continuing education units. Only for the incinerator technology II course is there a prerequisite and that is the completion of the incinerator technology I course or its equivalent. The courses are offered once each year. The incinerator technology and sanitary landfill courses are generally offered during June, while resource recovery is offered during the spring semester.

CURRENT FACULTY, STUDENTS, GRADUATES

Program faculty consists of two full-time members, both of whom have full-time teaching responsibilities. One is involved in part-time research, in solid waste management. In addition, the faculty is supplemented by twenty guest lecturers from industry and government agencies.

Student enrollment usually averages from ten to fifteen in each of the incinerator technology courses and between fifteen and twenty in the sanitary landfill and resource recovery courses. Approximately four hundred students have taken these courses since they were first offered. Most students come from New York State. Only about fifteen percent come from out-of-state. Recruitment is achieved primarily through the distribution of brochures and faculty contacts with professionals working in the field. The only student support available at present is a tuition payment program sponsored by the Long Island Sanitation Officials Association for its members. In the past, federal and state funds supported the program and kept the tuition at a minimal level.

The number of program graduates is between eighty-five and ninety percent of those enrolled in each course. Almost all students are already employed, so placement of graduates is not a problem. Approximately sixty percent work in municipal government jobs and the remainder work in private industry.

PROGRAM PROJECTIONS

Officials do not foresee any expansion of the program within the next year or two. However, each course is to be continually updated in the current state of the art.

COURSE DESCRIPTION

IT-1 Incinerator Technology I - A total of 30 hours devoted to the fundamentals of incinerator plant operations. Many current topics and a field trip are included. (3.0 CEU's)

IT-2 Incinerator Technology - Thirty hours devoted to the design and management of municipal incinerators. Current topics of interest are included. (3.0 CEU's)

SL-1 Sanitary Landfill - Thirty hours devoted to the design, operation, and management of sanitary landfills. Field trip. (3.0 CEU's)

RR-1 Resource Recovery - Three-day course on methods of resource recovery in operation, start-up and testing, or development. Economic feasibility and practicality of each method. (1.8 CEU's)

INSTITUTION: MICHIGAN TECHNOLOGICAL UNIVERSITY (MTU)

PROGRAM: Environmental Engineering

DEPARTMENT: Civil Engineering

DEGREE: Bachelor of Science in Civil Engineering (B.S.C.E.)
Bachelor of Science in Engineering (B.S.E.)
Master of Science in Civil Engineering (M.S.C.E.)

CONTACT: Dr. George K. Wadlin, Head
Department of Civil Engineering
Civil-Geology Building, Room 110
Michigan Technological University
Houghton, Michigan 49931
(906) 487-2520

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Students combine studies of chemical, biological and engineering backgrounds to understand and solve problems involving thermal pollution, emissions and air pollution, acoustics and sound abatement, water resources and quality and solid waste management. The program began in 1970. Courses are offered on a quarter system.

One of the five major areas of study in civil engineering at MTU is environmental engineering. Areas of concern are water collection, treatment and distribution, wastewater treatment, solid waste disposal, air pollution control, public health, watershed studies, reservoirs, water flow control, sediment transport, hydraulic machinery, irrigation dams and canals.

The B.S.C.E. is a well-rounded traditional civil engineering program in which the student may select approximately five technical elective courses in his/her field of study.

The B.S.E. is for those students who wish to concentrate their studies in the area of sanitary-environmental engineering. Each individual curriculum is developed by the student in consultation with the Professional Interest Group of the Civil Engineering Department. The student selects 25-30 technical elective courses to build a coherent environmental engineering program.

Major emphasis of the M.S.C.E. is water quality engineering and water resources engineering.

PROGRAM REQUIREMENTS

The Environmental Engineering Laboratories include 4,500 square feet equipped for studies of water quality and water and wastewater treatment processes. Major pieces of equipment include Treatment Process Pilot Plants, Beckman 915-A Total Organic Carbon Analyzer, Perkin Elmer 305-B Atomic Absorption Spectrophotometer, Gas Chromatograph, BOD Respirometer, soil penetrometer with loading frame. The Hydraulics-Water Resources Laboratory occupies about 6,000 square feet and is equipped for conventional hydraulic experiments and for meteorologic and hydrologic studies.

The environmental studies B.S.E. degree requires courses in the following areas:

Mathematics	26 quarter credits
Basic Science	40 quarter credits
Engineering Science	50 quarter credits
Engineering Analysis, design and system	40 quarter credits
Other courses	44 quarter credits

The M.S.C.E. requires 45 quarter credits and areas of emphasis are water resources engineering, water quality engineering, air quality engineering, or solid waste management.

The degree requirements for the 45 quarter credits are: 1) at least 18 credits must consist of 500 level courses; 2) not more than 18 credits can consist of 400 level courses; 3) 15 credits normally consist of Graduate Research (CE 500)--3-9 credits culminating in an engineering project report or 9-15 credits culminating in a thesis.

CURRENT FACULTY, STUDENTS, GRADUATES

Engineering disciplines are fully accredited by the Engineer's Council for Professional Development (ECPD). Four of 17 civil engineering faculty are directly involved in teaching the environmental courses.

Research funding has included U.S. Army Cold Regions Research and Engineering Laboratory, Corps of Engineers, National Science Foundation, Cleveland-Cliffs Iron Company, State of Michigan, Electric Power Research Institute, U.S. Department of Interior, and the Bureau of Mines. 1976-1977 funding was $584,000.

Undergraduates can participate in a co-op program during their junior and senior years. Thirty-five different companies and agencies offer opportunities for the students to receive valuable on-the-job training.

An undergraduate at MTU who has senior standing and who has a satisfactory undergraduate record may apply for permission to enroll in graduate study while completing the requirements for his bachelor's degree. Course credits earned after the application has been approved and not applied to the bachelor's degree may subsequently be applied toward an advanced degree. It is expected that a student accepted for early admission to a graduate program will complete all requirements for the bachelor's degree within 12 months.

	Enrollment	Graduates
B.S.E B.S.C.E.	135	25-35
M.S.E.S.	18	11

Types of graduate financial assistance are research assistantships (2), teaching assistantships, scholarships, cooperative arrangements with industry and hourly employment.

An alumni survey (1931-70) undertaken in 1971 showed that 11 percent of the 973 that returned usable questionnaires were involved in an environmental work area (sanitary engineering plus conservation and water supply.

PROGRAM PROJECTIONS

The faculty sees no change in the long-range goals and objectives of the program.

ADDITIONAL INFORMATION

An eight-member Industrial Advisory Committee was formed in April, 1977. Companies represented include Envirex, DuPont, Elzinga and Volkers, Inc., Lakeside Equipment, Department of State Highways and Transportation, Bechtel Associates Professional Corporation, Soil Testing Services of Wisconsin, Inc., Williams and Works. Members come from Michigan, Illinois, Delaware, and Wisconsin.

An annual summer program, "Women in Engineering," was held during 1977 for high school and transfer students. It began in 1973 and involves exposure to six fields of engineering plus applied technology and computer science through lectures and actual participation in laboratory projects. The lecturers are practicing women engineers from business, government, and industry. The only cost to the participants is transportation to and from MTU.

Participants are selected on a competitive basis. A strong background in math and science and an interest in technological studies is necessary. High school teachers and counselors are asked to recommend several female students who have the aptitude to engage in technological studies. High school science and math teachers as well as career counselors are also expected to participate in the workshops and learn more about engineering.

Three hundred forty-nine women from eleven states attended the three 1977 sessions which were each a week long. Fifty-three corporate friends and MTU sponsored the program. Instructional staff included women from Michigan Consolidated Gas Company, General Motors Corporation, Ford Motor Company, American Can Company, John Deere, Shell Companies, M. W. Kellogg Company, The Dow Chemical Company, Inland Steel Company, Black and Veatch Consulting Engineers, Upjohn Company, Sundstrand Corporation, Bechtel Corporation, Kimberly-Clark Corporation, 3-M Company, the Air Force, and MTU's School of Techology.

COURSE DESCRIPTION

Undergraduate:

CE104 Surveying I - Basic concepts and operations, quality measurements, distance and angular measurements, horizontal and vertical control, traverse computations. Use of transit, level, Geodimeter. Horizontal and vertical curves. (3 q.h.)

CE202 Civil Engineering II - An introduction to Fortran IV digital computer programming. Numerical analysis techniques. Problem-oriented computer languages. (3 q.h.)

CE351 Introduction to Environmental Engineering - A general survey of sanitary engineering covering water supply and sanitary sewerage systems, water and wastewater treatment, water quality, basic concepts of eutrophication of natural water, air pollution, solid waste disposal, and environmental health. (4 q.h.)

CE381 Soils Engineering - Study of the properties of soils and their application to the design of foundations and earth structures. (4 q.h.)

CE400 Professional Practice I - Presentation of the concepts and methods required to make decisions between engineering alternatives. (3 q.h.)

CE403 Professional Practice II - A study of the technique of preparing written and oral engineering reports. Study of types and purposes of engineering reports and lectures on engineering practice. (3 q.h.)

CE451 Water and Wastewater Treatment - Principles of physical, chemical, and biological processes employed in water and wastewater treatment. Design of selected individual units within water and wastewater treatment systems. (4 q.h.)

CE452 Examination of Water and Wastewater - Measurement of physical, chemical, and bacteriological parameters of water quality. Interpretation of these parameters with regard to the design and operation of treatment processes and to the control of the quality of natural water. (4 q.h.)

CE453 Environmental Impact and Protection - The relation of man's environment to public health and to its control from an

CE453 (Cont'd) - engineering viewpoint. Topics include the various federal and state laws and regulations pertaining to water quality, air quality, solid wastes and environmental impact. (3 q.h.)

CE454 Water Distribution and Wastewater Collection Systems - Application of basic courses in sanitary engineering and hydraulics to the analysis and design of water distribution systems, wastewater collection systems, and their appurtenances. (3 q.h.)

CE461 Hydraulic Engineering - A study of the hydraulics of flow in closed conduits and open channels including transitions and controls. Application to the hydraulic design of water supply, drainage and sewerage systems. (4 q.h.)

CE463 Hydrology - Study of relationship between rainfall and runoff as applied to water supply, water power, irrigation, soil erosion, and sanitary engineering. (3 q.h.)

CE464 Hydraulic Structures - The analysis and design of water-regulating structures including gravity dams, arch dams, earth dams, spillways, gates, stilling basins, and conduits. (3 q.h.)

ME104 Spatial Analysis - The theory of orthographic projection as related to the graphical solution of space problems. Elements of descriptive geometry involving space relationships of points, lines, planes, and surfaces. (3 q.h.)

ME431 Thermal Pollution - The course emphasis is on the application of thermodynamics, heat transfer, and fluid mechanics to the evaluation and control of thermal pollution. Laboratory experiments and field trips are included to assist in obtaining a proper perspective. (3 q.h.)

ME433 Noise Control Engineering I - Both theory and practice are emphasized in this course, which introduces the student to the analysis and measurement of sound and vibration as applied to noise control. The basic concepts of vibration and acoustic theory are developed and a variety of sound and vibration measuring equipment is used in laboratory experiments. The student works on team projects analyzing some actual noise problems. Special topics from the current literature in acoustics and noise control are presented. (4 q.h.)

ME435 Emissions and Air Pollution - The Federal Clean Air Act and the technical aspects of standards resulting from this act are studied including the technical approaches for meeting these standards. Control methods for mobile and stationary sources are studied. In addition, the theory for atmospheric dispersion from stationary stacks is developed and applied to a number of engineering problems. Measurement techniques for ambient, mobile, and stationary source emissions for hydrocarbons, carbon monoxide, ME435 (Cont'd) - nitrogen oxide, nitrogen dioxide, oxygen, particulate matter, and sulfur oxides are covered. (3 q.h.)

Graduate:

CE551 Solid Waste Management - A study of the quantity, characteristics, and handling of municipal solid wastes. Topics include current federal and state regulations, the analysis of collection operations, sanitary landfill design, and various resource recovery alternatives. (3 q.h.)

CE552 Industrial Waste Treatment - Study of the sources and control of water pollution from industrial waste. Topics include characteristics of major industrial wastes, waste reduction through water conservation and reuse, selected treatment processes, and joint treatment of municipal and industrial wastes. (3 q.h.)

CE553 Advanced Sanitary Engineering I - Advanced analysis and design of the physical, chemical, and biological processes employed in water and wastewater treatment. Emphasis is placed upon laboratory evaluations and on the scale-up of laboratory data for the design of water treatment systems. (4 q.h.)

CE554 Advanced Sanitary Engineering II - Continuation of CE553. Emphasis is placed upon laboratory evaluations and on the scale-up of laboratory data for the design of biological waste treatment systems. (4 q.h.)

CE555 Water Quality Hydrology - Examination of the effects of effluent discharges and runoff on surface and groundwater supplies. Emphasis is placed on describing and predicting the effects in quantitative terms. Methods for controlling and minimizing deleterious effects also are stressed. (3 q.h.)

CE556 Advanced Sanitary Engineering III - Continuation of CE554. Emphasis is placed upon laboratory evaluations and on the scale-up laboratory data for the design of advanced waste treatment and nutrient removal systems. (4 q.h.)

CE564 Water Resources Engineering - Advanced topics related to water resources engineering including: multiple purpose river development, economic analysis of river development, aspects of water law, and administrative aspects of water resources planning. (3 q.h.)

CE591-4 Seminar - Detailed study and group discussion of current literature and graduate research projects related to the broad field of civil and environmental engineering. Normally, several sections will be offered depending on the student's area of interest: environmental and water resources, structures, soils, construction, and transportation. At times, joint sessions will be held on subjects of general interest. (1 q.h. each)

INSTITUTION: RENSSELAER POLYTECHNIC INSTITUTE

PROGRAM: Environmental Engineering

DEPARTMENT: Chemical and Environmental Engineering

DEGREE:
Bachelor of Science (B.S.)
Master of Engineering (M.E.)
Master of Science (M.S.)
Doctor of Engineering (D.E.)
Doctor of Philosophy (Ph.D.)

CONTACT:
Dr. David Hansen, Chairman
Dr. William W. Shuster
Environmental Engineering Program
Chemical and Environmental Engineering Dept.
Rensselaer Polytechnic Institute
Troy, New York 12181
(518) 270-6377

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Chemical and environmental engineering are combined as disciplines at the Rensselaer Polytechnic Institute into the Chemical and Environmental Engineering Department. Rensselaer is one of the few institutions of higher education in the United States which offers a baccalaureate degree in environmental engineering. The Environmental Engineering Program builds on a broad base of studies in chemistry, life science, and engineering science in a three-year pre-engineering portion of the program, and during the senior year students receive specialized study in environmental engineering. The senior year consists of a sequence of courses designed around unit processes and integrated laboratory design courses. Employment for graduates of the program may be found in industry, consulting, government, research agencies and teaching.

On completion of the three-year pre-engineering curriculum, an undergraduate may continue to the two-year professional program leading to the Master of Engineering degree. Students electing the professional program may elect any of four options emphasizing water resources, solid waste, air pollution or radiological health. The Master of Engineering degree is awarded on completion of specified programs which are accredited by the Engineers' Council for Professional Development. The Master of Science degree is awarded on completion of a program which is individually arranged and appropriate to the major field. The Doctor of Engineering and Doctor of Philosophy degree programs are also arranged individually and emphasis is placed on advanced study in a specialty, with a major focus on thesis work. At the graduate level, students are encouraged to take cross-disciplinary studies using other Rensselaer courses outside of the department.

The department utilizes extensive research and instructional laboratories with a broad range of process and analytical instrumentation. Water resources laboratories are located at the Fresh Water Institute at Lake George. Current research is conducted in the study of water resources and its subtopics of treatment technology, environmental monitoring, and modelling of water ecosystems. Other environmental engineering research efforts are being directed in the area of air resources, solid wastes, radiological health, and other related areas. Some interdepartmental research is also being conducted with other departments in the areas of environmental acoustics, radiological health, water resources, and bioengineering.

PROGRAM REQUIREMENTS

Students seeking admission at the same level to the baccalaureate program must first be admitted to the university and satisfy the pre-engineering requirements. Junior college transfers can enter the program at the third year as long as their educational backgrounds are equivalent to what is offered during the first two years at Rensselaer. Department officials stated that prospective students should have taken four years of high school mathematics and science and have graduated in the top 10 percent of their class.

The Master of Engineering program, administered by the Professional School is EPCD-accredited, and graduates of other schools may be admitted with advanced standing and may normally complete the degree program in one year, if their baccalaureate engineering degrees are accredited. Master of Engineering candidates must: (1) be admitted to the Professional School of Engineering; (2) fulfull the general requirements; (3) complete the prescribed curriculum in the Professional School satisfactorily, and (4) complete an engineering project.

A total of 133 hours is required for completion of the Bachelor of Science degree in Environmental Engineering. In addition to the three-year pre-engineering program totaling 102 hours, the two-year Master of Engineering program requires completion of an additional sixty-one hours. The doctorate requires completing ninety credits beyond the bachelor's degree and a doctoral thesis or engineering project.

Although Rensselaer has established an Industrial Traineeship Plan, there is no sponsorship under this plan for environmental engineering students. The Chemical and Environmental Engineering Department does participate in a cooperative education program with industry. In the cooperative plan programs, students alternate periods of employment with periods of on-campus education; however, there is no financial support from the sponsor directly to the student's educational program.

Normal federal financial aid programs are available to students at the undergraduate level. At the graduate level, the only source of funding for students is research contracts. Training grants have almost disappeared and one U.S. Environmental Protection Agency fellowship is being funded. In addition, one industrial fellowship is available.

CURRENT FACULTY, STUDENTS, GRADUATES

Ten faculty members are currently involved with teaching and research activities associated with the Environmental Engineering program. Many faculty members are involved in both portions of department's program. It is estimated that there are four and one-half full-time equivalent faculty members each involved with teaching and research.

At the undergraduate level during the pre-professional program, students are not identified as being environmental engineering oriented. While there are about twenty seniors in environmental engineering, this is out of a total of about 800 senior undergraduates in the engineering school. There are no part-time undergraduate environmental engineering students enrolled.

Fifty-four graduate students have chosen to specialize in environmental engineering at Rensselaer. Of these, forty are full-time students; two are female. There are fourteen part-time students taking graduate environmental engineering programs, and of these, one is female. It is estimated that 3½ percent of the undergraduate and 5 percent of the graduate students in the School of Engineering elect environmental engineering.

Within the last five years, an average of twenty-five undergraduates received baccalaureate degrees in environmental engineering at Rensselaer. At the graduate level, within the last three years on an average, twenty students have received master's degrees and three have received doctorates.

With the decline of training grants from the U.S. EPA, Rennselaer has felt less tied to offering specific curriculum specializations to environmental engineering students. Emphasis at the undergraduate level has been placed on providing students with a solid fundamental environmental engineering background. Master's students are required to complete a six-credit thesis, and the topic is usually in the student's chosen area of specialization. Approximately one-third of the master's program includes required fundamental courses. About one-half of the environmental engineering students elect to specialize in the water resources area. One-fourth elect the air option, and one-fourth select the other two remaining areas of concentrations.

Due to increasing governmental cutbacks in hiring, most of the environmental engineering graduates have found employment within private industry (mainly consulting firms.) There are a consistent number of graduates employed by industry involved in the design and manufacture of equipment for environmental control. Other graduates find employment with research groups and within academia.

PROGRAM PROJECTIONS

Although the Rensselaer environmental engineering program is not expected to significantly change in size and emphasis over the next five years, research programs may be expanded. Two additional environmental engineers with air or water resources backgrounds may be recruited for an expanded research program. An environmental science degree may be developed at Rensselaer within the School of Science as the Biology Department is active in environmental studies.

Rensselaer officials expect enrollment in environmental engineering to begin to level out, and keep pace with population trends. More emphasis in the next few years is expected to be in the application of chemical processing in the pollution control areas. The curtailment of the EPA training grant program has had a serious effect on the number of students entering environmental engineering graduate programs at Rensselaer. Departmental officials feel that there is a need to reinstate the EPA training grant program.

A main attraction of the Rensselaer environmental engineering program is the fact that it is one of the strongest undergraduate programs in environmental engineering in the United States. The graduate program is also considered to be one of the premier environmental engineering programs in the nation.

COURSE DESCRIPTION

32.405 Unit Operations in Environmental Engineering - A study of the physical processes, termed unit operations, that are common to air, water, and land pollution control systems. (3 s.h.)

32.406 Unit Processes in Environmental Engineering - The study of several physical-chemical and biological processes encountered in environmental pollution control and water supply. (3 s.h.)

32.407 Environmental Acoustics - A study of man's total sonic environment. (3 s.h.)

32.409 Water and Wastewater Engineering - The topics studied are: estimates of water demands, water supply sources, water quality criteria, transmission and distribution of water, water pumping and storage systems, rural water supply and other topics. (3 s.h.)

32.415, 32.416 Environmental Engineering Laboratory I & II- Experiments are performed in the areas of water, wastewater, solid wastes and air pollution. (2 s.h. each)

32.423 Air Pollution: Sources and Effluents - Fundamental aspects of air pollution with emphasis on emissions from major stationary and mobile sources (automobiles). (3 s.h.)

32.431 Solid Waste Engineering - Classification and characteristics of solid wastes, the need for and rating of solid waste management systems, design of municipal refuse collection and transfer systems, methods and costs of solid waste disposal, and other subjects. (3 s.h.)

32.442 Industrial Waste Treatment and Disposal - Physical, chemical and biological characteristics of industrial wastes. (3 s.h.)

Graduate Courses:

32.601 Public Health I - Occurrence and control of communicable diseases; principles of epidemiology and biostatistics and their application, emphasizing the relationship with environmental factors; air pollution sources and health effects. (2 s.h.)

32.602 Public Health II - International, federal, state and county health organizations, responsibilities, and functions; water quality management and public water supplies; solid wastes management; radiological health controls; air resources controls and management. (2 s.h.)

32.603 Chemistry for Environmental Engineers - The weekly 3-hour laboratory emphasizes analytical measurements using instrumental techniques; most experiments are drawn from the water and wastewater field, a few from air pollution. (3 s.h.)

32.611 Water Resources - Elements of meteorology and hydrology. Precipitation, runoff, stream flow, watershed losses, unit hydrograph, and groundwater problems. (3 s.h.)

32.612 Physical Chemical Waste Treatment - The application of theoretical principles and pilot plant data to the design and operation of advanced waste treatment systems. (3 s.h.)

32.614 Stream Pollution Control - The economic aspects of water pollution; health aspects of bacterial pollution. (3 s.h.)

32.616 Environmental Impact Analysis - Studies related to the evaluation of the impacts of major actions by state and federal agencies on the quality of human environment. (3 s.h.)

32.620 Atmospheric Chemistry - The course presents important thermodynamic and kinetic aspects of reactions in the atmospheric layer. (3 s.h.)

32.622 Air Pollution Meteorology - Investigation of atmospheric processes of particular importance in dealing with the environmental problems of air pollution. (3 s.h.)

32.624 Air Pollution Control - The major approaches to air pollution control are discussed from three different viewpoints. (3 s.h.)

32.634 Environmental Radiation Safety Controls - Consideration and control of the health hazards peculiar to the atomic industry. (4 s.h.)

INSTITUTION: TEMPLE UNIVERSITY

PROGRAM: Environmental Technology (A.T.)
Environmental Engineering Technology (B.S.)

DEPARTMENT: Civil and Environmental Engineering Technology

DEGREE: Associate in Technology (A.T.)
Bachelor of Science (B.S.)

CONTACT: Dr. Frederick B. Higgins
Chairman of the Department of Civil and
Environmental Engineering Technology
Temple University
Philadelphia, Pennsylvania 19122
(215) 787-7816

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The College of Engineering Technology offers two degree programs relating to environmental pollution control; Environmental Technology and Environmental Engineering Technology. The Environmental Technology Associate degree curriculum is oriented toward the training of engineering technicians to perform environmental measurement and control tasks for either industry or governmental agencies. This program is accredited by the Engineer's Council for Professional Development and graduates are trained for positions as air pollution technicians, laboratory technicians, service technicians, technical representatives, and water quality technicians.

The Environmental Engineering baccalaureate curriculum is based on chemistry, biology, civil engineering, and chemical engineering aspects which would be most appropriate to study environmental quality deterioration and to the design of equipment or systems for pollution abatement and control. Students prepare for the practical application of control technology to pollution control and abatement. Students may select electives to emphasize engineering, social or management aspects. Graduates may obtain positions as project engineers with consulting companies in environmental control groups in industry, or in regulatory agencies.

The two programs utilize a wet chemistry laboratory for the analysis of environmental pollutants and an instrumentation laboratory which contains automated air and water pollution monitors. In addition, a bacteriological laboratory is available for students to use. Several pilot treatment plants are also available.

PROGRAM REQUIREMENTS

In order to be eligible for admission at Temple University sixteen units (one unit - one year) of acceptable high school work are required of which ten must include four units of English, two units of college preparatory mathematics, one unit of history, one unit of laboratory science and two units of a foreign language. College of Engineering Technology students are not required to satisfy the foreign language requirement but must instead present two additional units of mathematics and laboratory sciences.

The two-year Environmental Technology curriculum includes 66 semester hours of required courses plus an environmental field operations course (4 semester hours) during the summer between the second and third semesters. The four year Environmental Engineering Technology curriculum includes 124 credit hours of required courses over an eight semester period plus the summer field operations course.

The students participating in these programs can elect a cooperative educational arrangement as an option. Approximately three students participate each semester and the U.S. Environmental Protection Agency office in Philadelphia is the largest employer of Temple University's environmental students.

Although there are no specific departmental grants available to students as financial assistance, Pennsylvania has grants available entitled Pennsylvania Higher Education Agency and Basic Education Opportunity Grants and other forms of federal grants are available.

CURRENT FACULTY, STUDENTS, GRADUATES

Only two faculty professors are engaged in teaching Temple University's environmental courses offered in the two degree programs. However, other full-time faculty in other departments also teach major courses in noise control, solar energy, environmental impact assessment and energy and environment.

There are currently 64 full-time students (nine females) and twelve part-time students enrolled in the baccalaureate program. Eight students (3 females) are enrolled in the associate program. Approximately fifteen baccalaureate students and one to two associate degree students graduate annually. The baccalaureate program has been increasing steadily but not as rapidly as has been expected by program officials. Enrollment in the associate degree program has been low and appears to be declining.

Almost all of the associate degree students transfer into the baccalaureate program. However, only ten to fifteen percent of the Environmental Engineering Technology graduates continue for advanced degrees. Because of a state and city policy of hiring engineers and not technicians, few Temple graduates work for city or state environmental agencies. The U.S. EPA Regional Office in Philadelphia is a consistent employer of Temple graduates (2 each year). Recent graduates have also found employment with local water treatment equipment manufacturers and sales engineering firms (as technical representatives). Because the unavailability of public agency jobs in the Philadelphia area exists, eighty percent find private sector employment.

PROGRAM PROJECTIONS

Temple University plans to offer its first baccalaureate engineering degree program in the fall of 1978. Many of the environmental courses will be incorporated in the engineering curriculum. One day-adjunct instructor and six to seven evening adjuncts are expected to be recruited in the near future to teach energy and environment, air pollution, environmental impact preparation, and computer modelling courses. All will have engineering backgrounds and will teach specific courses on an adjunct basis. The Environmental Technology programs are acquiring a unit operations laboratory in a new building during 1978 and air/industrial hygiene will be taught in its facilities. The laboratory will be equipped with pilot scale water and wastewater treatment plants with capacities of between one-half to one million parts per million capacity.

As baccalaureate enrollment appears to be increasing steadily, a B.S. in Engineering Science with no departmental sponsor will be initiated. Ultimately an environmental engineering major will be developed, but no departmental degrees will be offered.

COURSE DESCRIPTION

10 Introduction to Environment - Evaluation of environmental conditions. (3 s.h.)

11 Energy & Environment - The effects of energy development and use on environmental quality. (3 s.h.)

13 Environmental Chemistry - Basic principles of chemistry and stoicheometry as they relate to environmental pollution measurements and chemical treatment. (3 s.h.)

17 Sanitary Chemistry & Microbiology - Wet analysis of environmental importance; sampling; data handling; standard test; microbiology. (3 s.h.)

24 Environmental Instrumentation - Optical, electrochemical and instrumental methods of analysis; environment applications. (3 s.h.)

31 Pollution Control Processes - Liquid and gas properties of importance in environmental control operations; sedimentation, filtration, membrane processes, adsorption, ion exchange, chemical treatment. (3 s.h.)

33 Environmental Field Operations - Field aspects of environmental engineering: Air and water sampling, stack sampling, bioassay and environmental aspects of planning. (4 s.h.)

110 Air Pollution Control Systems - Principles of design and operation of municipal and industrial wastewater treatment plants. (3 s.h.)

113 Solid Waste Management - Refuse collection and disposal incineration; landfill; composting; recycling; special wastes. (3 s.h.)

115 Water Treatment - Chemical and physical methods of treatment of water supplies. (3 s.h.)

116 Environmental Regulations - View of environmental regulations at the federal, state and local levels. (3 s.h.)

120 Environmental Systems Design - The practical design of pollution control systems in the areas of air, water, solid waste, industrial hygiene and noise. (3 s.h.)

210 Environmental Planning - Planning as a factor in minimization of environmental impact and on preparation of environmental impact statements. (3 s.h.)

211 Energy Resource Development - Current energy sources, available resources and methods of development. (3 s.h.)

390 Independent Study in Environmental - Student permitted to study a regular course on his own during the semesters the course is not offered, enabling student to meet prerequisite or graduation requirements. (2-4 s.h.)

398 Independent Research - Student will be assigned a research project with the approval of the department chairman and conducted under the supervision of a faculty sponsor. (2-4 s.h.)

INSTITUTION: THE PENNSYLVANIA STATE UNIVERSITY

PROGRAM: Environmental Engineering

DEPARTMENT: Civil Engineering

DEGREE: Bachelor of Science (B.S.)
Master of Science (M.S.)
Master of Engineering in Environmental Engineering (M.E.E.E.)
Doctor of Philosophy in Environmental Engineering (Ph.D.)

CONTACT: Dr. Raymond E. Untraver, Head
Department of Civil Engineering
212 Sackett Building
The Pennsylvania State University
University Park, Pennsylvania 16802
(814) 865-8391

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Environmental Engineering Program at Penn State was first initiated in September, 1972. It is really an expansion of the Bachelor of Science degree in Sanitary Engineering, a program first started in 1908. At the undergraduate level, the program is designed to provide a basic foundation in engineering supplemented by specialized study in the areas of air, water and solid waste, and radiological protection. All students in the program will receive instruction in one of them by selecting an option for his or her last four terms. A general option is available for those students who wish to postpone specialization to a graduate level program. The major is an interdisciplinary one within the College of Engineering and it is administered by the Department of Civil Engineering. Continuous liaison is maintained with the College of Earth and Mineral Sciences.

The Environmental Engineering degrees at the graduate level are administered entirely by the Civil Engineering Department. The graduate program can also provide specialization in the areas of air, water, or solid waste.

Most students obtain employment with consulting engineering firms, regulatory agencies and industry.

Extensive laboratory facilities are provided for Environmental Engineering in the departments of the two colleges involved with research and instruction. The Department of Civil Engineering has laboratory facilities for instruction and research in the areas of water, wastewater and solid waste. The Department of Mechanical Engineering has laboratories in the area of air pollution control. Additional research and laboratory space is available in the Center for Air Environment

Studies. The Department of Nuclear Engineering operates the Breazeale Nuclear Reactor with laboratory facilities in the area of radiological protection. Facilities are avsilable in the College of Earth and Mineral Science laboratory in the areas of geochemistry, hydrogeology, and mineral processing.

PROGRAM REQUIREMENTS

Candidates with a baccalaureate degree in a field of engineering are eligible for the advanced degrees. The degree should be from an institution accredited by the Engineer's Council for Professional Development. In order to enter the College of Engineering as an undergraduate, three units of English, three units of mathematics (1½ units of algebra, 1 unit of plane geometry, and ½ unit of trigonometry), one unit of science, and eight other units are required during high school preparation.

For the B.S. degree in Environmental Engineering, 140-143 credits are required, depending on the option selected. Required are 67-68 baccalaureate degree requirements, 51 credits of major requirements and 22-24 credits for the option (general, 22; air, 22; radiological, 24; and water and solid waste, 23).

Requirements for the Master of Science degree in Environmental Engineering include 30 semester credits of course work (20 to be completed in residence), a thesis, and a twelve month completion period. No language proficiency is required.

The Master of Engineering degree in Environmental Engineering requires completion of 30 credits in residence with 27 credits in course work and 3 credits directed to the Engineering Report.

The Doctor of Philosophy degree in Environmental Engineering requires completion of a candidacy exam, language exam, comprehensive exam, dissertation, and final oral exam.

A five-year work study program in environmental engineering is available and includes alternating periods of study and employment. Two years of engineering experiences and money to offset educational costs are acquired by students admitted to this program.

At the graduate level, one and one half departmental graduate assistantships are available. Sponsored research projects are the funding sources for additional assistantships.

CURRENT FACULTY, STUDENTS, GRADUATES

Ten full-time faculty members make up the interdisciplinary faculty which teach the undergraduate level courses. Eight are from Civil Engineering (5 water quality; 3 water resources hydrology); one is from Mechanical Engineering (air pollution); and one is from the Nuclear Engineering Department (radiation). Six professors from the

Department of Civil Engineering make up the graduate Environmental Engineering staff. They devote about 70 percent of their time to teaching and 30 percent to research activities. Most research funding is from industry although the City of Philadelphia does provide some funding for research.

There are currently (Fall, 1977) a total of 130 (12-15 female) full-time students enrolled in the undergraduate program. Included are two to three part-time co-op students. At the graduate level, 19 students (1 female) are enrolled in advanced degree programs. An average of 23 undergraduates and eight graduates annually earn degrees from the Environmental Engineering program.

Approximately 20-25 percent of the undergraduates continue on for advanced degrees. Most master's students continue on to other educational institutions for doctorates. In previous years, most (60 percent) of the master's students were continuing on for doctorates at Penn State. Eighty percent of the program's graduates have obtained employment in their field and 70 percent have found jobs in the private sector, mostly with consulting engineering firms. Consulting engineering firms make an active recruitment effort of Penn State students. Only 30 percent of the program's graduates have found positions in government agencies.

PROGRAM PROJECTIONS

The Environmental Engineering Program is now at maximum capacity and little additional growth is projected. No change from the current emphasis is expected. During the last two to three years, the enrollment has increased greater than what was anticipated. Financial constraints prevent the hiring of any additional staff members for the program.

COURSE DESCRIPTION (SELECTED)

Biol 410 General Limnology - Organisms found in inland waters; biological factors affecting their distribution and relationship; intensive studies of our local streams. (3 s.h.)

Biol 435 Ecology of Lakes and Streams - Physical, chemical, and biological characteristics of freshwater environments, with special emphasis on factors regulating productivity in freshwater ecosystems. (3 s.h.)

Bio 481 Aquatic Botany - Identification, collections, and relationships of higher aquatic plant groups; field study of habits. (3 s.h.)

CE 51 Engineering Hydrology - Water sources and losses in nature; effects of precipitation, evaporation, and subsurface percolation on streamflows; flood prediction, water resource management. (2 s.h.)

CE 70 Water Pollution Control -Quantity and quality of municipal and industrial water and waterwater. Unit operations and treatment processes for water pollution control. (3 s.h.)

CE 371 Water and Wastewater Transport Systems - Water storage and transmission; design of water distribution and sewerage systems; pumps and pumping systems. (2 s.h.)

CE 451 Advanced Hydrology - Recent advanced in deterministic, stochastic, and urban hydrology. (3 s.h.)

CE 471 Environmental Sanitation - Public health engineering applications related to communicable diseases, water supply, wastewater disposal, solid wastes, air pollution, food, vectors, and radiation. (3 s.h.)

CE 472 Water Pollution Control Processes - Principles and design of unit operations for water; domestic and industrial wastewater treatment; equipment selection and application. (3 s.h.)

CE 473 Water Quality Management - Water quality criteria and standards; fate and impact of pollutants in aquatic systems; technology available for wastewater renovation. (3 s.h.)

CE 476 Solid Waste Management - Solid waste collection, salvage and disposal techniques for municipalities and industries; cost analyses; legislation; management; financing; design optimization. (3 s.h.)

CE 570 Physical Chemical Treatment Processes I - The theory of physical-chemical processes used in the treatment of potable water and municipal and industrial wastewaters. (2 s.h.)

CE 571 Physical Chemical Treatment Processes II - The theory of physical-chemical processes used in the treatment of potable water and municipal and industrial wastewaters. (3 s.h.)

CE 572 Biological Treatment Processes - The theory of biological processes used in the treatment of municipal and industrial wastewaterss. (3 s.h.)

CE 574 Laboratory Analyses in Water Quality Control - Experiments illustrating current chemical and biochemical methods of water and waste treatment and analytical methods used in research and control. (3 s.h.)

CE 575 Industrial Waste Treatment - Surveys and data analysis; use of unit processes to meet regulatory agency requirements; disposal of gaseous and solid residues. (2 s.h.)

CE 577 Treatment Plant Design - Design of works for the treatment of water and wastewater for municipalities and industries. (1-6 s.h.)

CE 579 Aquatic Microbiology - Ecology and physiology of microorganisms of inland waters, estuaries, and oceans; microbiology of wastewater treatment. (3 s.h.)

CE 580 Stream and Estuarine Analysis - Quantitative assessment of advection, reaction, and dispersion processes in polluted waters; reaeration theory; eutrophic systems; analog simulation. (3 s.h.)

FS 430 Air Pollutants from Combustion Sources - Generation of pollutants in combustion chambers; reduction by combustion control; pre- and post-combustion treatment of fuels and effluents.

HPA 420 Environmental Health - Identification, evaluation and control of environmental hazards. Biological and social considerations of the interaction of human populations with their physical environment. (3-6 s.h.)

ME 58 Acoustics and Noise Control - Sources, measurement, description of environmental noise, transmission loss, noise reduction at source by absorption, isolators and mufflers, noise measurement exercises. (3 s.h.)

ME 458 Noise Control in Machinery - Nature of noise sources in machine elements and systems. Propagation and reduction of noise. (3 s.h.)

METAL 460 Pollution Control in the Mineral Process Industries - Recycle, utilization and pollution control of air, water, and solid wastes from mineral processing plants. Pollution control through process modification. (3 s.h.)

METEO 310 Introduction to Atmosphere Science - Survey of atmospheric processes and analytical methods of atmospheric science. (3 s.h.)

METEO 452 Hydrodynamics of the Atmosphere - Equations of motion; circulation and vorticity; elements of turbulence theory and perturbation theory; introduction to numerical weather prediction. (3 s.h.)

METEO 453 Atmospheric Thermodynamics - Thermodynamic properties of the atmosphere with emphasis on water vapor; applications to forecasting problems. (3 s.h.)

METEO 475 Chemistry of the Atmosphere - Chemical properties of atmospheric components and contaminants. Dispersion and removal processes in connection with cloud physics, circulation, and air pollution. (3 s.h.)

MICRB 400 Introductory Environmental Microbiology - Elementary ecological relationships of microorganisms in the biosphere; role of bacteria in water pollution and purification. (2 s.h.)

MN EC 484 Political Economy of Energy and the Environment - Energy-its nature, use, markets and environmental impacts. (3 s.h.)

MNG 400 Mining and our Environment - For nonmining students. Nontechnical treatment of mining methods, practices, and role in today's civilization; socioeconomic and environmental problems. (3 s.h.)

NUC E 428 Radioactive Waste Control - Nature, sources, and control of radioactive wastes; theory and practice of disposal processes. (3 s.h.)

INSTITUTION: THE PENNSYLVANIA STATE UNIVERSITY

PROGRAM: Environmental Pollution Control

DEPARTMENT: Intercollege

DEGREE: Master of Science (M.S.); Master in Environmental Pollution Control (MEPC); Master of Engineering (ME)

CONTACT: Dr. John B. Nesbitt
Charge of Graduate Programs in Environmental Pollution Control
226 Merrell R. Fenske Laboratory
Pennsylvania State University
University Park, Pennsylvania 16802
(814) 865-1226

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

First initiated in 1971, the Environmental Pollution Control Program is an intercollege program dealing with various aspects of the control of air and water pollution and the disposal of solid wastes. Options are available in: Air Environment; Basic Physical and Biological Sciences; Environmental Health; Environmental Resource Management; Land Environment; Mathematics, Statistics, and Computer-Science; Noise; Planning; Pollutant Control in Industrial Processes; Radiological Protection; Systems Analysis; Water Resources - Quantity; and Water Resources Quality. An interdisciplinary faculty committee and participating departments provide graduate instruction. Other graduate faculty members other than those in the committee have a teaching and/or research interest in the area of environmental pollution control. Graduates are prepared to enter positions with consulting engineering firms, state, local, and federal regulatory agencies, and in private industry. Many have found positions with the Pennsylvania Department of Environmental Regulation and the Department of Transportation. Some have found employment with the U.S. Geologic Survey and EPA, for example. They have served in the capacities of operation plant inspectors, water or air pollution control specialists (not engineers), engineering assistants or technicians, and have prepared environmental impact assessments for consultants.

Research facilities utilized by the program's students are those maintained by the various participating departments at the University. There are none specifically designated for the Environmental Pollution Control Program. Research work conducted by students are sponsored by the various departments associated with the program.

PROGRAM REQUIREMENTS

Admission into the program is granted upon the recommendation of the head of the academic department in which the student plans to complete a program and the environmental pollution control program faculty committee. Mathematics through integral calculus, and one year of work in both general physics and chemistry is normally required for admission. Considered for admission are students with appropriate backgrounds in mathematics and science and a 2.75 junior-senior average.

Students enrolled in the Environmental Pollution Control Program are required to pass 9 credits of EPC core courses and 3 credits of EPC 590 seminars. One credit of the seminar in air is given during the fall term, one in water is given during the winter term, and one credit in solid waste management is offered during the spring. The core courses are: CE 472, Water Pollution Control Processes; CE 476, Solid Waste Management; and ME 470, Fundamentals of Air Pollution. Students not choosing to major in Water Pollution Control may substitute CE 473, Water Quality Management for CE 472, Water Pollution Control Processes.

In addition to the 12 credits of core courses and seminars,a minimum of 12 of the remaining 18 credits required for the master's degree must be selected from the EPC recommended courses list.

Master of Environmental Pollution Control: at least 9 of the student's total credits must be at the 500 level and these 9 credits should not include EPC seminars or credits taken to write the MEPC paper.

Master of Science in Environmental Pollution Control: at least 18 credits at the 500 and 600 level and these may include the EPC Seminars; and for most departments a thesis must be written.

Students can develop, with the help of an advisor in the selected department of affiliation, a program that will specialize in one area yet provide a basic comprehension of the problems encountered in other areas of environmental pollution control. The proposed program study, approved and signed by the student's advisor, is normally submitted to the program office within the first three weeks.

The student advisor, the head of the department of affiliation, and the EPC Program Chairman, determine the requirements concerning the research paper or thesis.

The university provides eight terms (2 years) of financial assistance to graduate assistants. Additional graduate assistance is provided through the student's departmental affiliation and usually involves work on funded research projects.

CURRENT FACULTY, STUDENTS, GRADUATES

A total of forty faculty members contribute to the offering of the courses in the program. Thirty-three faculty are senior graduate faculty members and seven are associate graduate faculty members. They devote about 70 percent of their time to teaching activities and 30 percent to research.

There is a total of 26 full-time students enrolled in the Environmental Pollution Control Program. All except one student are male and there is only one part-time student in the program. About one-half of the students are affiliated with the Civil Engineering Department and the rest are from Agronomy, Veterinary Science, Mining Engineering, Geography, Meterology, Food Science. and Biological Health. Ten to fifteen students have graduated annually in recent years and the four-year average is 14 students. Enrollment and the number of graduates have remained relatively stable over the past couple of years.

The Environmental Pollution Control Program is designed to be a terminal Master's program. Resumes of students enrolled in the program and the Center for Air Environmental Studies are published and mailed to prospective employers. This has resulted in rather successful placement of graduates. About 95 percent of graduates find employment in their field and the rest are unknown. Approximately 30 percent find positions in governmental agencies, 40 to 50 percent in the private sector, and 20 percent in academia and other areas. Most finding positions with the Pennsylvania Department of Environmental Regulation serve as operations plant inspectors, conducting stream surveys, water or air pollution control specialists. Those finding positions with consulting firms are employed as engineering assistants or technicians, prepare 208 Areawide Planning Studies, prepare environmental impact assessments, and in sales. Some graduates take further fluid mechanics or waste treatment courses and thus obtain engineering work with consulting firms.

PROGRAM PROJECTIONS

Because of time and fiscal constraints, no change is expected to develop with the Environmental Pollution Control Program. The present orientation of the program is considered to be adequate in structure and no additional faculty members are expected to be recruited. There appears to be a leveling off of enrollment in the program to 25 to 30 per year.

COURSE DESCRIPTION

(the following is a partial listing of courses)

CE:

451 Advanced Hydrology - Recent advanced in deterministic, stochastic, and urban hydrology. (3 s.h.)

472 Water Pollution Control Processes - Principles and design of unit operations for water; domestic and industrial wastewater treatment; equipment selection and application. (3 s.h.)

474 Management of Water Pollution Control Processes - Personnel requirements, record systems, unit process operation and control, laboratory control and equipment maintenance systems. (3 s.h.)

476 Solid Waste Management - Solid waste collection, salvage and disposal techniques for municipalities and industries; cost analyses; legislation; management; financing; design optimization. (3 s.h.)

554 Urban Hydrology - Several hydrograph methods. Design storm and IUH application; airport drainage; flood plains; impact of urbanization upon groundwater and sediment. (3 s.h.)

570 & 571 Physical Chemical Treatment Processes I & II - The theory of physical-chemical processes used in the treatment of potable water and municipal and industrial wastewaters. (2-3 s.h.)

573 Problems in Environmental Pollution Control - Investigations, analyses, and reports on current topics in environmental pollution control. (3 s.h.)

575 Industrial Waste Treatment - Surveys and data analysis; use of unit processes to meet regulatory agency requirements; disposal of gaseous and solid residues. (2 s.h.)

Mechanical Engineering

405 Air Pollution Control Systems - Small particles formation, properties, and behavior; equipment design and instrumentation; air pollution control, atomization, mass transfer, filtration. (3 s.h.)

458 Noise Control in Machinery - Nature of noise sources in machine elements and systems. Propagation and reduction of noise. (3 s.h.)

470 Fundamentals of Air Pollution - Nature, sources, transport, control, and effects of pollutants; sampling methods; air quality criteria and standards, economics, and planning. (3 s.h.)

Microbiology

400 Introductory Environmental Microbiology - Elementary ecological relationships of microorganisms in the biosphere; role of bacteria in water pollution and purification. (2 s.h.)

Recreation and Parks

542 Environmental Law - Legislative, judiciary, administrative processes-roles; citizen action; legal concepts; litigation and enforcement tactics for protection and enhancement of natural environment. (3 s.h.)

Nuclear Engineering

420 Radiological Safety - Ionizing radiation, biological effects, radiation measurement, dose computational techniques, local and federal regulations, exposure control. (3 s.h.)

INSTITUTION: THE PENNSYLVANIA STATE UNIVERSITY

PROGRAM: Environmental Resource Management
DEPARTMENT: Interdepartmental - College of Agriculture
DEGREE: Bachelor of Science (B.S.)

CONTACT: Dr. John R. Daugherty
In Charge of Environmental Resource Management Program
201 Ferguson Building
The Pennsylvania State University
University Park, Pennsylvania 16802
(814) 865-6942

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Started in 1971, the Environmental Resource Management Program was revised in 1975 from a generalist emphasis to emphasize specializations in order to allow students to meet job market criterion. This interdepartmental major is designed to train students to help resolve the conflicting demands for the utilization of natural resources and to develop rational programs for the use of the environment. Graduates have broad training and problem solving ability in areas such as applied biology and ecology, environmental quality, management of the various renewable resources, economics, and the related social sciences and humanities.

Graduates are qualified (depending on their technical course selections) to serve in specialized areas such as resource manager, soil conservationist, land manager, and environmental protection specialist. They are qualified to analyze complex environmental and pollution problems, to prepare and evaluate environmental impact statements, and to develop integrated plans for the multipurpose use of natural resources. They obtain employment with governmental agencies at the federal, state, regional, and local levels or with public utilities and industries which use or affect renewable resources. The major also prepares students for graduate work in one of the specialized areas of environmental science. Students in the program have access to the College of Agriculture's research and study facilities.

PROGRAM REQUIREMENTS

In order to enter baccalaureate degree programs in the College of Agriculture, three secondary school units of English and 12 units from other subject areas are required. The College of Agriculture recommends, but does not require for admission, 3 units each of science and mathematics, including trigonometry.

The Bachelor of Science degree in Environmental Resource Management requires a total of 135 semester credits for graduation. Included are 80-85 credits of baccalaureate degree requirements, 46 credits of major requirements, and 6-9 credits of electives. Graduation requirements for this major include the completion of the following university level courses:

- 4 courses (12 credits) in communication skills, including a course in technical writing;
- 4 courses (10-13 credits) in statistics, calculus, and computer science;
- 10 courses (27-30 credits) in the natural and biological sciences, including biology, botany, zoology, ecology, wildlife, plant growth and development, and microbiology;
- 5 courses (14 credits) in the physical sciences, including chemistry and physics;
- 3 courses (9 - 10 credits) in the area of geology, soils, and water management;
- 5 courses (15 credits) in the area of economics, land economics, political science, management, and the various legal aspects of environmental problems;
- 4 courses (12 credits) in the social sciences and humanities; and
- 3 courses (9 credits) related to environmental pollution and to the systematic analysis of environmental problems and resource problems.

In addition, graduates from this major will have completed 3 to 6 technical courses in a specialized area, of the student's choice, related to environmental quality or to resource management.

The College of Agriculture administers an internship cooperative program with U.S. Steel, planning commissions, sewage treatment commissions, McKeever Environmental Center, the U.S. Forest Service, and the U.S. Soil Conservation Service. Four students participate in training a training program run by American Cynamic Corporation to sell pollution control equipment and prepare water pollution abatement programs.

Most of the students enrolled in the program receive financial assistance from the normal federal programs (e.g., Basic Educational Opportunity Grant Program). The College of Agriculture does provide some funding and course loans.

CURRENT FACULTY, STUDENTS, GRADUATES

Only one full-time faculty member is attached to this program, although there are thirteen faculty advisors representing six departments available to assist students enrolled in the program. Eight different programs from three different Colleges of the University are involved in the teaching of the Environmental Resource Management curriculum, plus the College of Engineering's Civil Engineering Department (water pollution control). Ten instructors teach major field courses and technical field courses can be taught by any number of departments, depending on the student's emphasis.

There are currently a total of 583 students (114 female) enrolled as full-time students. There are no part-time students enrolled in this program. Enrollment has significantly increased from the 1976-66 school year when 534 students were enrolled.

An annual average of 110 students complete the program and receive the B.S. degree. A total 116 students received the degree in 1977 and there were 101 graduates in 1976. Enrollment is up so it is anticipated that a total of 150 students will receive the B.S. degree in 1978.

Only ten percent of the program's graduates continue on for advanced degrees. Two-thirds of those continuing stay at Penn State and obtain degrees such as the M.S. in Wildlife Management or Biology. Others enter fresh water programs offered by the University of Washington or Wisconsin or continue on to Colorado or Michigan State Universities.

Approximately 60 percent of the program's graduates find employment directly in their field. About 10-15 percent find professional positions in a related field and 15-20 percent find unrelated jobs. At the present time, governmental agencies are hiring relatively few persons in the field because of funding cut backs. Students in the upper half of their class, and with good, solid, cohesive technical course groupings are doing relatively well in the job market. Participation in summer trainee programs, jobs, and practicum work in the student's area of interest also enhance place ability. Recent trends indicate that about one-half of graduates find private sector jobs and the other one-half find government positions.

PROGRAM PROJECTIONS

Recent increases in enrollment have forced the program to offer courses twice a year rather than once (e.g., Case Studies, Agronomy, Agricultural Engineering). The faculty is expanding the offering of programs. There is not expected to be any change in the present structure because of the recent modification that has been accomplished from a generalist structure to offering technical specializations. Program officials would like an environmental pollution monitoring laboratory course for their students. The program is attempting to obtain access to a laboratory with pollution measurement equipment, in order that students can utilize its facilities.

COURSE DESCRIPTION

The following seven Environmental Resource Management courses are to be taken as core requirements. In addition, the program has available tehcnical courses to enable a student to specialize so as to develop competency in some area. Specialized technical courses aer available from the following groupings: Pollution Control; Biology-Ecology; Environmental Health; Soil Resources; Resource Economics; Environmental Policy; Freshwater Resources; Wildlife Resources; Air Pollution; Marine Resources; Pests and Pesticide Management; Societal Resource Organization and Distribution; Energy Production; Forest Resources; General Resource Management; and Business.

300 Junior Seminar - Discussion of selected topics in environmental resource management by staff and representatives of government and industry. (1 s.h.)

400 Senior Seminar - Preparation and presentation of a report covering a specific topic in environmental resource management. (1 s.h.)

401 Special Studies - Supervised independent study. (1-8 s.h.)

410 Legal Aspects of Resource Management - Legal systems and lawmaking processes, property rights in land, water and wildlife resources; jurisdictional problems in planning resource use. (3 s.h.)

411 Legal Aspects of Resource Management - Legal systems and lawmaking processes, property rights in land, water and wildlife resources; jurisdictional problems in planning resource use. (3 s.h.)

412 Resource Systems Analysis - The concept of systems; techniques of analysis, including input/output, mathematical programming, and simulation; application to resource systems. Prerequisites: 6 credits in mathematics, 3 in statistics, and 3 in ecology. (3 s.h.)

413 Case Studies in Ecosystem Management - Application of biological, physical and social science principles to ecosystem management problems; introduction to environmental impact statement preparation and review. Prerequisites: 6 credits each in the biological, physical, and social sciences. (3 s.h.)

INSTITUTION: UNIVERSITY OF IOWA

PROGRAM: Environmental Engineering

DEPARTMENT: Division of Energy Engineering

DEGREE: Master of Science (M.S.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Richard R. Dague
2216 Engineering Building
University of Iowa
Iowa City, Iowa 52242
(319) 353-3388

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The program began in 1927, offering a degree in "sanitary engineering". Until 1968 students with a B.S. engineering background were the only ones admitted to the graduate program. Since that time, a second option (undergraduate degrees in a basic science area) has become available. The degrees must have a major in one of the physical, chemical, biological or mathematical sciences. Two of the eight major areas of study (environmental, mechanics and hydraulics) at the UI's College of Engineering offer degrees at only the graduate level.

Programs of study are designed to develop a high level of competence in water quality, air quality, solid wastes management, or general. Sixteen to eighteen hours are required in each speciality area.

PROGRAM REQUIREMENTS

Minimum undergraduate grade-point average (GPA) is 2.5 for admission to the Masters program. A non-thesis plan of study requires 33 credit hours and 3 credits for a major report; thesis - 24 credit hours and 6 hours of research.

Ph.D. admission requires a Master's degree with a thesis in either engineering or basic science; GPA is 3.2 on previous graduate work. A minimum of 72 semester hours of credit beyond the basis undergraduate degree is required. Eighteen of these hours may be applied to thesis research. A one year on-campus residency is also required.

Core courses vary for the student coming into the program with the applied science or engineering background. Prospective students should contact the department for more detailed information. Elective courses are permitted to complete the program if approved by the student's advisory committee (3 members for Masters and 5 for Ph.D.).

CURRENT FACULTY, STUDENTS, GRADUATES

Weekly seminars are held for environmental engineering students. Speakers are graduate students, professors or outside professionals. Some topics covered in the Fall of 1977 were "Trends in Energy Development", "Lake Erie: Is It Really Dead or Does It Always Smell That Way?", Pesticide Interactions in Iowa Rivers or Betcha Shouldn't Eat Just One (Fish)".

Students are taken on major field trips to Chicago, Minneapolis or St. Louis, in-state field trips and national meeting yearly. Most expenses for these trips/meetings are assumed by the department.

Laboratory facilities and office space for students engaged primarily in wastewater treatment research are located at the Philip F. Morgan Research Laboratory. This facility is located on the grounds of the Iowa City municipal wastewater treatment plant, an 8 mgd treatment facility. The "Morgan Lab" contains 2,000 square feet of space devoted to a wet-chemistry laboratory and areas for bench and pilot scale studies. The lab also contains a full-scale section of an aeration tank with a volume of 10,000 gallons.

The 4 mgd University Water Treatment Plant provides 4,500 square feet of laboratory and office space. The "Water Plant" lab is fully equipped for both the routine and advanced chemical and biological analyses of water. The water plant facility is unique in that the plant is designed not only to produce a potable water for the University community, but also to allow the full scale study of specific unit operations and processes.

Present enrollment in the Ph.D. program is five; 27 full-time and 25 part-time in the M.S. Graduates number 15--one Ph.D. and 14 Masters. Financial aid is available through research assistantships, fellowships, contracts with private industry and grants.

Six faculty engage in research and teaching on a full-time basis. Five others hold joint appointments or routinely participate in the department activities. Research has been funded by and conducted for the Department of Energy and a number of private industrial clients.

PROGRAM PROJECTIONS

The long-range goals and objectives of the program are to expand, attracting and graduating more students.

ADDITIONAL INFORMATION

The Iowa Institute of Hydraulic Research was founded in 1920 and now deals with a host of problems ranging from the dispersion of thermal and other pollutants in air and water to the movement of ships through ice-covered waters and super-sonic aircraft through the air. The Environmental Engineering Program works closely with the Institute of Hydraulic Research on many research projects and contract studies. Similar working relationships are maintained with the Institute of Agricultural Medicine and Environmental Health and the Institute of Urban and Regional Research, also on the University of Iowa campus.

A 40 hour workshop that taught the techniques of value analysis with special emphasis on the requirements of the EPA's mandatory VE study in Step II Program was held in June, 1977. The title was "Environmental Specialty Workshop on Value Engineering in Wastewater Treatment Plant Design". It was sponsored by UI's College of Engineering in cooperation with the Iowa Section, American Society of Civil Engineers and Consulting Engineers Council of Iowa.

The College of Engineering and Iowa State University, in cooperation with Iowa Department of Environmental Quality, Iowa Water Pollution Control Association and Iowa Section American Water Works Association sponsored the Eleventh Advanced Water and Wastewater Works Operators Education Course in November, 1977.

COURSE DESCRIPTION (A partial listing)

General Courses: 527:104 Environmental Planning and Assessment - Planning for and the assessment of the environmental impacts of man-made systems, including transportation, water resource, power generation, housing and other facilities. (2 s.h.)

Environmental Sciences: 523:150 Principles of Environmental Engineering - Physical, chemical and biological principles of water and wastewater treatment, air pollution control and solid wastes management. (3 s.h.)

523:151 Hydraulic Systems Design in Environmental Engineering - Application of hydraulic principles to the design of transport systems in environmental engineering with emphasis on water transmission and wastewater and storm water collection and treatment systems. (3 s.h.)

524:152 Environmental Chemistry - Principles of general, qualitative, organic and physical chemistry applied in water and air systems. (3 s.h.)

524:153 Environmental Chemistry Laboratory - Laboratory procedures in the routine physical, chemical and biological analysis of water, wastewater and solid wastes. (2 s.h.)

524:154 Environmental Microbiology - Fundamentals of microbiology with applications in water quality and wastewater treatment systems. (3 s.h.)

524:155 Limnology - Physical, chemical and biological characteristics of natural waters with emphasis on the relationships between the biota and the physiochemical aspects of the aquatic environment. (2-3 s.h.)

524:156 Environmental Operations and Processes - Theory of physical, chemical and biological unit operations and processes in water and wastewater treatment. (3 s.h.)

524:157 Environmental Engineering Design - Practical aspects of the design of water and wastewater treatment systems. (3 s.h.)

524:158 Air Pollution and Solid Wastes - Sources, characteristics and effects on environmental quality of air pollutants and solid wastes. Analysis and design of control systems, including the recovery of resources from solid wastes. (3 s.h.)

522:159 Meteorological Aspects of Air Pollution - Selected topics in meteorology and climatology, particularly those affecting transport, dispersion and modification of pollutants; impact on community planning and plant design. (2 s.h.)

528:160 Air Pollution and Control Technology - Air pollution causes and effects; diffusion through the atmosphere with meteorological, climatological and topographical effects; chemical reactions and natural cleansing mechanisms; concepts in control technology. (3 s.h.)

524:250 Water Quality - Design of advanced water and wastewater treatment systems. Topics include the application of physical, chemical and biological processes to the removal of nitrogen, phosphorus, dissolved solids and refractory compounds from water and wastewater and the application of wastewater liquids and sludges to land. (2 s.h.)

524:251 Environmental Systems Modeling - The mathematical modeling of environmental processes, including aquatic, atmospheric, terrestrial and treatment systems. Study, analysis and application of existing models. (2 s.h.)

524:252 Advanced Environmental Chemistry - Lectures and laboratory dealing with advanced concepts and instrumental methods in the analysis of water, wastewater, air and solid wastes. (3 s.h.)

524:254 Environmental Toxicology - The nature and sources of toxic substances in the environment and their metabolic and ecological effects on humans and other living forms. (2 s.h.)

524:256 Environmental Systems Laboratory - Laboratory evaluation and discussion of the unit operations and processes in water and wastewater treatment with emphasis on the interpretation of theoretical concepts in full-scale systems. (3 s.h.)

524:257 Industrial Water Quality Control - Quantity, quality and treatment of various industrial process waters. Sources, characteristics and treatment of industrial wastewaters to meet effluent standards and requirements for multiple use and re-use. (3 s.h.)

524:258 Solid Wastes Technology - Analysis and design of solid wastes management systems, including collection and processing by shredding, bailing, incineration, pyrolysis and biological stabilization. Ultimate disposal by landfilling. (3 s.h.)

Fluid Mechanics: 523:065 Flow Systems in Environmental Engineering - Application of the principles of hydrology and hydraulics to the analysis and design of water and wastewater transfer systems. (3 s.h.)

INSTITUTION: UNIVERSITY OF MISSOURI-ROLLA

PROGRAM: Environmental and Sanitary Engineering

DEPARTMENT: Civil Engineering

DEGREE: Master of Science in Civil Engineering (M.S.)
Doctorate in Civil Engineering (Ph.D.)

CONTACT:

Dr. J. H. Senne, Chairman
Department of Civil Engineering
University of Missouri-Rolla
Rolla, Missouri 65401

Dr. Ju-Chang Huang, Area Head
Environmental & Sanitary
Engineering Program
Department of Civil Engineering
University of Missouri-Rolla
Rolla, Missouri 65401

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

This program is administered by the Department of Civil Engineering and is open to qualified students in engineering and related physical and life sciences. It offers a strong and well rounded curriculum consisting of graduate training and research in the areas of water and wastewater engineering, air pollution control, and solid waste management. It is well supported with departmental offerings in other areas, primarily water resources engineering, hydrology and hydraulic engineering, environmental and planning engineering; complemented with courses in other engineering and science disciplines; and strengthened by a strong and expanding research program.

PROGRAM REQUIREMENTS

Graduate study in environmental and sanitary engineering usually leads to the Master of Science and Doctor of Philosophy degrees in Civil Engineering. There are two programs available to the students at the master's level; the first requires a minimum of 30 semester credit hours and the preparation of a research thesis, while the second is a non-thesis degree requiring at least 33 semester credit hours. In both cases at least six semester hours must be taken outside the Civil Engineering Department. Most students undertake the thesis option. Depending upon their background and experience, students who have not received their undergraduate training in civil engineering might be required to take deficiency undergraduate work in water and wastewater engineering in order to better prepare themselves for the graduate program.

Beginning with the Fall 1971 semester a program has been offered at the UMR St. Louis Graduate Engineering Center, and today approximately 35 practicing engineers and scientists from the Greater St. Louis area are pursuing graduate study leading to the M.S. degree on a part-time basis.

Graduate course offerings include water and wastewater engineering, air and water resources, solid waste management, and a selected group of supporting courses in engineering and science. Each student formulates with the advice and consent of his advisor, an individual program of graduate study and research which is best adapted to his own interest and preparation. While considerable emphasis is given to basic sciences and fundamental concepts so necessary for understanding sanitary engineering processes and operations, the main thrust is toward engineering.

CURRENT FACULTY, STUDENTS, GRADUATES

The faculty consists of seven full-time professors under the direction of a program area head. Four professors and the area head are Professional Engineers.

Currently, eleven men and two women are enrolled full-time in the masters program; there is one doctoral student. The program offers off campus courses in St. Louis; 45 persons are enrolled as part-time masters students in St. Louis.

Graduates have little difficulty finding employment. They often have several offers. About half take positions in the public sector and half in the private sector.

PROGRAM PROJECTIONS

No changes in program structure are anticipated in the near future.

ADDITIONAL INFORMATION

The program frequently offers short courses for Professional Engineers in the field. Environmental impact assessment seminars have been presented.

COURSE DESCRIPTION

(The following is a partial listing of courses)

Chemistry: 355 Instrumental Methods of Chemical Analysis - Special analytical techniques including colorimetry, electrometric methods, electrolytic separations, polarography, spectrophotometry, X-ray spectroscopy, flame photometry and radiochemistry. (3 s.h.)

373 Atmospheric Chemistry - A chemical study of the troposhere including composition; nucleation, growth stability, distribution, diffusion, and fallout of aerosols; and meteorological aspect. (3 s.h.)

Civil Engineering: 309 City Planning - Consideration is given to each of the six major subdivisions of city planning, 309 (Cont'd) - comprising streets, transit, transportation, public recreation, zoning and civic art; history of city planning; laws governing various phases. Work includes a city layout on a topographic map with attention paid to probable future development of the city concerned. (2 s.h.)

327 Advanced Structural Design - The design of structural systems to formalize the student's knowledge of the behavior of individual components into a final integrated structure. Continuous span highway bridges, culverts, retaining walls, rigid frames, multi-storied buildings and similar type problems of interest to the student. (3 s.h.)

331 Hydraulics of Open Channels - The phenomena accompanying the flow of water in open channels, such as uniform and varied flow, critical conditions, shooting flow, backwater curves, hydraulic jump, drop, and applications are studied in detail. (3 s.h.)

333 Intermediate Fluid Mechanics I - Kinematics of fluid motion, conservation of mass, linear and angular momentum, and energy. Requirements for similarity of fluid flow. Introduction to dynamics of ideal fluids and viscous incompressible flows. Comparison of control volumes and system approaches. (3 s.h.)

336 Intermediate Fluid Mechanics II - Continuation of C.E.333 at an advanced level. General considerations of irrotational and axially symmetric incompressible irrotational flows. Advanced studies of viscous incompressible flows. Introduction to boundary layer theory. (3 s.h.)

338 Hydrologic Techniques - A study of current up-to-date hydrologic techniques involving design of hydrologic input for bridges, culverts, reservoirs. Techniques involve extreme value statistics, model hydrographs, routing, etc. (3 s.h.)

362 Public Health Engineering - A comprehensive course dealing with the environmental aspects of public health. (3 s.h.)

363 Solid Waste Management - A systematic study of the sources, amounts and characteristics of solid wastes and methods used for their collection, reclamation, and ultimate disposal. (3 s.h.)

364 Solid Waste Laboratory - A companion course to CE 363 for those students desiring experience in refuse characterization, analysis and quantity determinations along with disposal operational controls. (1 s.h.)

365 Sanitary Engineering Analysis - Quantitative measurement and benchscale pilot plant investigation in the fields of water, sewage, industrial waste, and stream pollution. Interpretation and application of test data. (3 s.h.)

367 Air Pollution Abatement I - Comprehensive study of air pollution abatement with emphasis on sources, causes, effects, and general control methods. (3 s.h.)

368 Air Pollution Abatement II - Comprehensive study of air pollution abatement with emphasis on sampling, measurement, and control. (3 s.h.)

369 Sanitary Engineering Design - Functional design of water and wastewater treatment facilities. (3 s.h.)

380 Water Resources and Engineering - Application of engineering principles to the planning and design of multipurpose water resources projects. Latest concepts in engineering analysis are utilized to enable the student to ultimately evaluate alternative solutions to water resources problems.

400 Special Investigations - Advanced work, individual in character but not leading to a thesis. (s.h. arranged)

401 Special Topics - Special lectures in an area of civil engineering of immediate interest to graduate students, which may develop into a continuing graduate course. (s.h. variable)

431 Advanced Hydraulics and Hydraulic Engineering - Studies in the field of hydraulic engineering to fit the needs of a particular student or class. Each student makes a complete design of a hydraulic development in one of the following fields; water power, sanitation, river and harbor projects. (s.h. variable)

438 Advanced Hydrology - A study of methods used in modern hydrologic analysis and design. Items of study include hydrograph analysis, maximum possible storm, infiltration, design flood determination and project feasibility. (3 s.h.)

439 Similitude and Model Studies - The use of models and analogies as aids to engineering design. Principles of dimensional analysis. Application to problems of fluid flow and structures is emphasized. (3 s.h.)

440 Urban Hydrology - Studies of the influence of urban areas on their hydrology. Special emphasis on the principles of spatially varied unsteady flow. Model hydrographs leading toward determination of design storm flow are utilized to obtain information necessary for design of storm sewers, channels, and hydraulic structures common to urban areas.

461 Sanitary Microbiology - A study of the principles and applications of the microbiology involved in environmental health and water resources engineering. (3 s.h.)

462 Water Treatment - A detailed study of the theory of water treatment with applications to design and operation. (3 s.h.)

463 Waste Water Treatment I - A detailed study of the theory of sewage and industrial waste treatment with applications to design and operation including consideration of receiving waters. (3 s.h.)

464 Waste Water Treatment II - A comprehensive study of the fundamentals of industrial waste treatment and characterization including laboratory pilot plant investigations. (3 s.h.)

469 Advanced Sanitary Engineering Design - A detailed study of the functional design of modern water purification and sewage treatment plants with emphasis on unit operations and processes. (3 s.h.)

480 Water Resources Engineering I - A study of water resources. Consideration is given to the conception and planning for developments to control and utilize water resources, including historical, institutional, and legal aspects. (3 s.h.)

481 Water Resources Engineering II - The design, construction and operation of developments to control and utilize water resources. The student's background in engineering science, design, humanities, and social sciences is drawn upon to include all aspects of a project. (3 s.h.)

Engineering Management: 314 Organizational Theory and Corporate Structure - Development of the theories and practices of planning, controlling, organizing, and directing the industrial enterprise. Application of these management theories to the functional elements of the corporate organization. (3 s.h.)

327 Legal Environment - Study of the effect of the legal environment on the decisions which the engineering manager must make. The course investigates the social forces that produced this environment and the responsibilities incumbent upon the engineer. (3 s.h.)

386 Safety Engineering Management - Principles of safety engineering applied to industrial situations; job safety analysis and specification of solutions; reduction of accident rates, frequency and costs; protective equipment, jigs, fixtures and standards, rules, regulations and laws. (3 s.h.)

456 Advanced Personnel Management - Current practices of procurement and maintenance of technical personnel in research, development, and design organizations. Adaptation of such personnel to the technological enterprise, current practices in personnel administration, labor management relationships. (3 s.h.)

INSTITUTION: UNIVERSITY OF PITTSBURGH

PROGRAM: Environmental and Sanitary Engineering

DEPARTMENT: Civil Engineering

DEGREE:
Bachelor of Science (B.S.)
Master of Science (M.S.)
Ph.D. in Civil Engineering

CONTACT:
Dr. Joel I. Abrams
Chairman of Civil Engineering Department
University of Pittsburgh
Room 949 Benedum Hall of Engineering
Pittsburgh, Pennsylvania 15260
(412) 624-4141

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The Department of Civil Engineering first started granting degrees in 1846 and fields of specialization are currently offered in Sanitary Engineering, Water Resource Engineering, and Mine Environmental Engineering and Reclamation. Graduates are employed in positions involving water resources, water supply, waste disposal, air pollution and environmental sanitation. Many graduates find positions with consulting engineering firms (including sales) in research, teaching, and governmental agencies.

Work for full-time students and a complete part-time program are strong points of the Master's degree program. Water resources and environmental engineering are specialty areas in the doctoral program and active research is on-going in both of these areas.

The Environmental and Sanitary Engineering program emphasizes research and courses in the following areas:
Chemistry and biology;
Water analysis for water quality control;
Pollution and control of natural waters;
Unit processes and operations applied to the design of water and wastewater treatment plants;
Solid waste disposal;
Disposal of sludges and concentrates;
Economics;
Administration of sanitary engineering facilities; and
Basin studies and regional environmental planning.

The Department's Sanitary Engineering Laboratories have the necessary equipment and instrumentation for determining all the standard wet chemical and microbiological analyses of water and wastewater. Two walk-in incubators and all the latest equipment for the newer sophisticated instrumental techniques are included in these facilities.

PROGRAM REQUIREMENTS

Applications to the graduate program may be considered on an individual basis, but for the applicant who is a recent graduate with a degree from a school accredited by the Engineer's Council for Professional Development (EPCD), admission is granted on the basis of the undergraduate record, and usually an applicant with a B average will be granted admission.

At the undergraduate level, electives are available during the sixth, seventh, and eighth terms to enable a student to pursue an individualized program in the environmental and sanitary engineering area. The Bachelor of Science degree requires completion of 121-123 credits and the undergraduate program is noted for its flexibility in accomodating student interests in environmental and sanitary engineering.

Graduate students prepare a plan of study during their first term and assistance is provided by a faculty advisor. The Master of Science degree is offered with a thesis and a non-thesis option. The thesis option requires completion of a minimum of 24 course credits (eight courses) plus a thesis (six credit minimum). Students electing the non-thesis option are required to complete ten courses for 30 course credits (minimum) and prepare a three credit project. Graduate Preliminary Examinations are given to determine the admission of a marginal case. A Comprehensive Examination is given to all non-thesis program students and to some thesis program students. A Final Oral Examination is given to evaluate the findings of the student's M.S. thesis or project and related course work. Graduate research assistants are required to write a thesis upon recommendation of the advisor and project supervisor.

In order to complete the requirements for the Doctor of Philosophy degree, a minimum of 30 course credits (ten courses) in a major area, a minimum of 18 course credits (6 courses) in a minor area (one or two minor areas, but one outside the Civil Engineering Department), a minimum of six course credits (two courses) in Analytical Techniques, and a minimum 18 credits of dissertation are required. A Plan of Study and Proposal Conference is administered by the faculty advisor and a member of the faculty in the student's major and minor areas of interest. All Ph.D. students take a Comprehensive Examination toward the end of their course work and the Final Oral Examination of three hours duration, is administered by the Doctoral Committee.

A wide variety of financial aid packages are available to graduate students enrolled in the School of Engineering. Fellowships are offered to exceptional students as an unrestricted grant. Traineeships are offered in selected areas and there are usually restrictions on the courses which are allowed to be taken. Tuition scholarships provide for partial or full remission of tuition. Research assistantships are awarded as research contracts and teaching assistantships and teaching fellowships are awarded from department funds for assistance in laboratories, recitation sections, and for other teaching duties.

CURRENT FACULTY, STUDENTS, GRADUATES

Eight faculty members teach the environmental and sanitary engineering courses offered by the Civil Engineering Department. Approximately one-half of their time is devoted to research activities. Funding for research comes from the National Institutes of Health, the Department of Energy (ERDA), the National Science Foundation, and the American Iron and Steel Institute. A joint U.S. Environmental Protection Agency and American Iron and Steel Institute project on industrial wastes will be forthcoming to the Department. Most research work by faculty in the areas of heavy metals (using biological treatment to remove heavy metals) and in the pollution effects resulting from energy production and conversion.

The Civil Engineering Department has 320 Bachelor of Science students (including 40 female) enrolled in the fall term, 1977 and 35 students (five female) have elected to take environmental and sanitary engineering courses as electives. About 100 students receive the B.S. degree annually.

At the graduate level, there are a total of 220 students (70% part-time) enrolled in the M.S. and Doctor of Philosophy degree programs in the Civil Engineering Department. Approximately 175 are M.S. candidates and 35 are Ph.D. candidates. Of students electing the environmental and sanitary engineering option, 60 are M.S. students (3 female) and 20 are Ph.D. students (one female). Approximately 35 M.S. degrees and three to four Ph.D.s are annually granted by the department. In the environmental and sanitary engineering area, about 15 of the 35 M.S. graduate and two Ph.D.s are students participating in the program.

About forty percent of the B.S. students and fifteen percent of the M.S. students continue on for advanced degrees. Most students choose to continue their studies at the University of Pittsburgh. There are many part-time students enrolled in the M.S. degree program mainly because of the availability of jobs in the area. Virtually all graduates find employment directly in their field and it is estimated that 80 percent find jobs in the private sector and 20 percent find positions in government. Most finding private sector jobs are employed in consulting engineering firms.

PROGRAM PROJECTIONS

It is not anticipated that the program will significantly increase in the foreseeable future as the Civil Engineering Department has completed a growth phase during the past two years. The program is at a plateau phase but greater emphasis may be given to sanitary engineering, laboratory experimental work, mathematical modelling, hydraulic systems, urban hydrology, and urban pollution in subsequent years. It is expected that only one additional faculty member with expertise in mathematical modelling of lakes will be recruited in the next few years.

COURSE DESCRIPTION (SELECTED)

217 Economics of Projects in Environmental and Civil Engineering - Economic theory applied to use and control of project management and evaluation. Case studies from water resource field. (3 s.h.)

218 Planning, Administration, Management and Legal Aspects of Projects in Environmental and Civil Engineering - Administrative concepts of water pollution control and other Civil Engineering Projects at all levels of government. Government planning and construction aid programs for environmental control. (3 s.h.)

240 Hydraulic Engineering - Review of fundamental hydraulics. Hydraulics of flows in closed and open conduits. Hydraulic structures. (3 s.h.)

242 Hydraulic Transport of Solids - Hydraulic transport of solids in pipelines and open channels. Hydraulics of multi-phase flows. Applications in design of slurry pipelines and open channels and sediment transport in natural waters. (3 s.h.)

244 Surface Water Hydrology - Hydrologic cycle as a deterministic and stochastic system; rainfall-runoff relations; hydrograph analysis, frequency analysis and extreme value theory; design applications. (3 s.h.)

245 Groundwater Hydrology - Mechanics of flow through porous media. Darcy's law, potential flow theory, steady and unsteady flow to wells, practical aspects of well design, numerical methods, leaky aquifer theory. (3 s.h.)

250 Sanitary Engineering Biology - The fundamentals of biology and biochemistry are discussed, particularly as applied to natural waters and wastewater treatment systems. (4 s.h.)

252 Water and Wastewater Analysis - Principles and applications of quantitative chemical analyses of water and wastewater. (4 s.h.)

254 Water Pollution of Natural Waters - Natural history of water bodies, characteristics of natural water, ecological principles, sources and effects of pollutants, assimilative capacity, oxygen balance, eutrophication, acid mine drainage, thermal pollution, stream standards, water quality monitoring, basin planning. (3 s.h.)

255 Water and Waste Treatment Plant Design - Step-by-step development of a complete plant design for a hypothetical city. Design will be rational and empirical, not theoretical. Process design, equipment selection, economic evaluation, and plant layout will be emphasized. (3 s.h.)

259 Current Topics in Environmental Resources - Group discussion of selected readings and investigation into events of current environmental interest. (3 s.h.)

265 Advanced Environmental Systems Laboratory - Functional design, simulation, and evaluation of elements of environmental systems. (Var. cr.)

267 Advanced Social and Environmental Systems Analysis - Time series analysis, estimation of recursive systems, the identification problem, estimation of simultaneous equation systems. Environmental application. (3 s.h.)

340 Selected Problems in Water Resources - Applications of theories and principles to various practical problems and current topics in water resources. (3 s.h.)

351 Unit Operations of Water Treatment - Theory of several unit processes and operations as applied to water treatment. (3 s.h.)

356 Solid Waste Disposal - Theory, design and operation of systems for the collection and disposal of solid wastes. Course includes study of composition of municipal garbage and refuse and available collection methods. (3 s.h.)

365 Environmental Assessment - Methodology of technology assessment; environmental impact analysis, environmental indicators and the strategic environmental analyses system; case studies; the 1972-74 SST review. (3 s.h.)

390-391 Sanitary and Environmental Engineering Seminar - Current sanitary and environmental engineering subjects. (1 s.h.)

INSTITUTION: VANDERBILT UNIVERSITY

PROGRAM: Environmental and Water Resources Engineering/Solid Waste

DEPARTMENT: Environmental Engineering and Policy Management

DEGREE: Master of Science (M.S.)
Master of Engineering (M.Eng.)
Doctor of Philosophy (Ph.D.)

CONTACT: Dr. Karl B. Schnelle, Jr., Chairman
Department of Environmental Engineering
and Policy Management
Vanderbilt University
Nashville, Tennessee 37240
(615) 322-4757

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

Environmental engineering began at Vanderbilt in 1962. Five years later Sanitary and Water and Wastewater Resource Engineering became a department. After six major departmental changes, the name became Environmental Engineering and Policy Management.

The primary focus of advanced level studies in this department is on the development of modern quantitative techniques and their application to practical problems encountered in the field of environmental pollution and control. Advanced analytical, numerical, and statistical methods are combined with elements of water quality, systems analysis, hydraulics, biology and chemistry to provide the necessary background for conducting significant design, planning and research in the environmental area.

Current research projects include studies on thermal pollution, waste assimilation, stratified flow dynamics, industrial waste treatment, biological waste treatment, effects of pollutants on water quality in reservoirs, and methods of environmental education for the public. Students are all required to use computers in course work and are encouraged to use computer analyses in their research projects. Research needs of the program are served by the Joint University Libraries System which holds more than 1.25 million volumes and a catalog of 6,373 periodicals. The air pollution laboratory houses a full range of sampling, flow measuring, and analytical equipment including several automatic recording type instruments. In addition, a partial analytical equipment inventory includes a gas chromatograph, ultra-violet and infrared spectrophotometers, Zeta Meter, and a recording polargraph. Complete facilities are available for water analysis, including atomic absorption, spectrophotometry, and gamma-ray spectrometry. Extensive facilities for water and wastewater treatment pilot plants and hydraulic research (including a 60 foot flume) are available.

PROGRAM REQUIREMENTS

A bachelor's degree in engineering or science, completed with a 3.0 (on a 4.0 scale) grade average is required for admission to the Department of Environmental Engineering and Policy Management. Competence in given areas is a key factor, not necessarily how many courses one may have taken.

The normal requirements for an M.S. degree include the completion, with a B average, of at least twenty-four semester hours of formal course work, and the submission of a thesis. Students have the option in this program of following a non-thesis plan which requires thirty semester hours of graduate study, presentation of an oral report to a research seminar on a subject in the field of investigation, and submission of a written account of this work to the supervisory professor.

An advanced professional degree which is especially designed for engineering practitioners who prefer to continue working while engaged in graduate study is available. Students may complete one course at a time and have seven years to finish the Master of Engineering degree. Thirty semester hours, including twelve hours in the candidate's chosen program, are required. The remaining hours may be approved courses in other programs. At least twelve hours must be chosen from courses designated as Engineering Graduate Professional Courses.

Five options for specialization exist. They are: Water and Wastewater Treatment Engineering, Water Resources, Air Resources, Solid Waste, and Environmental Science. A core curriculum for each has been developed to guide the students through their respective programs. Should the curricula not be pursuant to the needs of a student, then together with his/her advisor, a request for variance may be filed with the director of the program. This request should be made early in the course of a student's study.

The following courses comprise the curriculum for the option in Solid Waste: EWRE 271 - Environmental Chemistry, EWRE 278 - Hydrology, EWRE 295 - Solid Waste Management, EWRE 300 - Water Quality Management, EWRE 318 - Systems Analysis for Environmental Engineers, EWRE 362 - Management of Solid Waste Collection Systems, EWRE 363 - The Management of Solid Waste Disposal Systems, and MATH 252 - Statistical Analysis for Environmental Scientists and Engineers.

Individuals wishing to pursue the Doctor of Philosophy degree will design programs of study, in consultation with their advisors, which are specific to their educational objectives. The doctoral program normally takes two and one-half to three years of work beyond the M.S. degree level. The first two years are generally devoted to course work and to preparation for the general examination which admits one to doctoral candidacy. Most students require one year to complete the dissertation, work on which ensues after the second year. The final public oral examination is held after the dissertation is submitted, and consists of a thesis defense and an examination of the student's expertise in his/her field of study.

CURRENT FACULTY, STUDENTS, GRADUATES

Including the department chairman, there are the equivalent of nine full-time faculty whose primary focus is on teaching. During 1977, there were six persons enrolled in the Master of Engineering program, sixteen in the Master of Science program, and ten seeking the Ph.D. degree.

Approximately 50 percent of the graduate students are receiving financial assistance. Such aid is available to all M.S. and Ph.D. candidates in amounts up to $4,000 per year plus tuition. The EWRE program has a variety of fellowships and assistantships available. Students who are receiving support from fellowships or traineeships, or from research or teaching assistantships may take normal course loads.

While precise figures were not available, it is estimated that 40 percent of the graduates from the past three years have beem employed by the Environmental Protection Agency, 25 percent have been employed by state agencies, 10 percent by other federal agencies, and 25 percent by private consulting firms and industry.

PROGRAM PROJECTIONS

Since its inception, this department has undergone six major upheavals. The result of that constant flux is that now officials are striving to achieve departmental stability.

There is currently a moderate recruitment effort being made. Officials would like to see the master's enrollment level reach forty.

COURSE DESCRIPTION

Math 252 Statistical Analysis for Environmental Scientists and Engineers - Frequency distributions, central tendency, dispersion, classical distributions, comparison of means and variances, correlation, linear and nonlinear regression. Applications to environmental studies. (3 s.h.)

EWRE 222 Methods of Scientific Research - Scientific investigation as illustrated by study of case histories. Preparation for research, hypotheses in science, planning experimentation, the role of chance in scientific discovery, intuition in science, reasoning in science; difficulties in research, style and taste in research, strategy in research, scientific knowledge, and social values. (2 s.h.)

EWRE 270 Public Health Engineering - Principles of public health engineering, study of vector control, communicable disease control, milk and food sanitation, refuse disposal, and general environmental sanitation. (2 s.h.)

EWRE 271 Environmental Chemistry - Theoretical aspects of physical, organic, and inorganic chemistry as applied to environmental engineering problems. (3 s.h.)

EWRE 272 Microbiology of Water, Waste Water, and Air - Principles of biology and their application to environmental science with emphasis on microbiology of air, water, sewage, and industrial wastes. (4 s.h.)

EWRE 273 Environmental Chemistry Laboratory - Chemical analysis of water and waste water and the laboratory control of water purification and waste water treatment processes. (3 s.h.)

EWRE 277 Open Channel Hydraulics - Resistance in open channels. Hydraulic design of channels. Steady, non-uniform flow (backwater curves). Unsteady, non-uniform flows. Methods of characteristics. Numerical solutions for unsteady flows. (3 s.h.)

EWRE 278 Hydrology - Hydrologic cycle, study of precipitation, evapotranspiration, stream flow, flood flow, ground water, flood routing, snowmelt, and hydrometerology. (3 s.h.)

EWRE 279 Economics and Law of Air and Water Resources - Economics of air and water resource conservation and development, water rights, public policy and laws relating to air and water resources. (3 s.h.)

EWRE 280 Atmospheric Pollution - Fundamentals of atmospheric pollution and control. Sources and nature of gaseous and particulate air pollutants, relation of meteorological conditions to their dispersal, and their effects on health and materials are discussed along with administration, standards, and control of air pollution. (3 s.h.)

EWRE 295 Solid Waste Management - Introduction to problem of solid waste management; types and quantities of wastes, collection and transportation of wastes; composting, landfill, incineration; recycling of wastes and product recovery; resource management system. (3 s.h.)

EWRE 300 Water Quality Management - Effects of physical, chemical, biological, and physiological pollutants in streams, reservoirs, and estuaries; fate of pollutants in the environment; water quality criteria; water quality management methodology. Biological aspects of water quality control. (3 s.h.)

EWRE 318 Systems Analysis for Environmental Engineering - Differential equation models derived from basic principles of heat, mass and momentum transport, reaction kinetics, and mixing and blending. Digital and analog computers are used to obtain solutions to equations. Application of differential equations to problems such as the dispersion of pollutants in rivers. (3 s.h.)

EWRE 321 Water Treatment Theory and Practice - Drinking water standards, advanced study of theory of operation of water treatment operations and processes, relation of theory and design practice, analysis and design of water treatment units. (3 s.h.)

EWRE 322 Waste Treatment Theory and Practice - Theory and practice of biological waste treatment. Treatment of municipal and industrial wastewaters by biological processes. Design and operation of biological waste treatment facilities. Principles and practice of sludge dewatering and disposal. Advanced wastewater treatment. Analysis and design of waste water treatment systems. (3 s.h.)

EWRE 333 Air Pollution Control - Design and operation of air pollution control equipment. Methods of application of control in various industries. (3 s.h.)

EWRE 334 Air Pollution Meteorology - Basic meteorology of urban atmosphere and effects on air pollution. Structure and properties of atmospheric boundary layer; atmospheric turbulence and diffusion; isolated point, line volume, and area sources; buoyant plume rise; building effects; urban climatology and meteorology; urban air pollution models. (3 s.h.)

EWRE 345 Water Resources Engineering - Case studies of important problems in water resources engineering. Stratified flow, thermal pollution, eutrophication, tracer techniques, optimization techniques, submerged jets, hydraulic models, water power engineering, and water resources planning. (3 s.h.)

EWRE 362 Management of Solid Waste Collection Systems - Selected problems pertaining to reference materials, methods of collection, methods of storage, equipment and transportation. Comparison of municipal, contract, and private collection systems. Financing refuse collection operations, organization, personnel, equipment management, cost accounting and budgeting, and public relations. Analysis and planning of refuse collection systems. (3 s.h.)

EWRE 363 The Management of Solid Waste Disposal Systems - Quantities and composition of refuse, selecting disposal methods, sanitary landfill, analysis of central incineration, composting, salvage, reuse, reclamation, reprocessing, and recycling. Design and analysis of refuse disposal systems. (3 s.h.)

INSTITUTION: WEST VIRGINIA UNIVERSITY

PROGRAM: Environmental Engineering

DEPARTMENT: Civil Engineering

DEGREE: Master of Science in Civil Engineering (M.S.C.E.)
Master of Science in Engineering (M.S.E.)

CONTACT: Dr. William J. Wilhelm, P.E.
Professor and Chairman of Civil Engineering
Civil Engineering Department
West Virginia University
Morgantown, West Virginia 26505
(304) 293-3867

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The environmental engineering program of the Civil Engineering Department at West Virginia University was long oriented toward sanitary engineering and hydraulics. The program was constructed mainly between 1962 and 1967. In 1963 air pollution courses were incorporated and in 1967 solid waste courses were added. In 1976, the program was expanded with the addition of water resources courses. Because at the graduate level no rigid curriculum is prescribed for the degrees of Master of Science in Civil Engineering and Master of Science in Engineering, students may specialize in two or more specialty areas. Specialties are offered in air pollution control, solid waste management, water and wastewater treatment and water resources.

Students choosing to specialize in air pollution control and abatement are prepared to assume positions in local, state or federal regulatory agencies. Many students specialiaing in the water areas have found positions with industrial firms (eg. Union Carbide) or with consulting firms.

PROGRAM REQUIREMENTS

In order to enter Graduate School at West Virginia University, applicants with a baccalaureate degree, or its equivalent, from a department accredited by the Engineer's Council for Professional Development (ECPD) will be admitted on the same basis as engineering graduates of the University. If these requirements (ECPD) are not fulfilled, then the applicants must first fulfill the requirements of the department in which the advanced degree is sought.

For the Master of Science in Engineering degree, each candidate must fulfill a planned program conforming to one of the following (with the approval and discretion of the graduate committee):

(1) A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
(2) A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
(3) A minimum of 36 semester credit hours, with no thesis or problem report required.

A thesis or problem report is normally required of all candidates and a candidate shall be required to pass an examination which may be written, oral, or both, to be administered by the student's advisory and examining committee. Depending on the program followed, the examination covers course material and the thesis or problem report.

No rigid curriculum is required for the Master of Science in Civil Engineering and Master of Science in Engineering degrees. At least fifteen semester hours credit should normally be selected from graduate civil engineering courses. Only those holding a baccalaureate degree in civil engineering are allowed to complete the requirements for the Master of Science in Civil Engineering degree. The Master of Science in Engineering degree is available to students who enter the graduate program but do not possess a baccalaureate degree in civil engineering.

Financial assistance available to graduate students enrolled in the environmental engineering program includes: U.S. EPA air pollution training grants; contract research (research assistantships); one-half time teaching fellowships; National Science Foundation Coal-Energy Traineeships; and West Virginia University foundation fellowships.

CURRENT FACULTY, STUDENTS, GRADUATES

Five full-time faculty members teach the bulk of the environmental engineering courses. Assistance is provided by three adjunct professors funded through the National Institute for Occupational Safety and Health. Approximately one-half of their time is devoted to teaching and one-fourth time each devotes to research and professional activities. Current research projects they are involved with include two Department of Energy (ERDA) projects and one million dollars of state money for two projects concerning air pollution control and acid mine coal drainage control.

There are currently twenty graduate students enrolled full-time in the program and all except three are male students. There are no part-time graduate students enrolled in the program. Ten students have been graduating annually in recent years in the Master's programs. Enrollment has been rather stable over the past several years.

Few graduate students enrolled in this program continue on for additional degrees. About ninety percent find employment in their field and ten percent in a related field. Recent employment trends indicate that most graduates (75 percent) find government jobs and only 25 percent find jobs in the private sector.

PROGRAM PROJECTIONS

There is not expected to be any significant growth in this program in the next several years. Expansion primarily depends on what government research is needed in the next few years. No faculty changes are also anticipated. At West Virginia University there is an attempt to develop an Environmental Health Science Program on campus. Program officials continue to foresee environmental programs continuing to be strong as long as the federal government continues to put funds into programs through research.

COURSE DESCRIPTION (SELECTED)

146 Sanitary Engineering I - Hydrology as applied to water and waste systems. (3 s.h.)

147 Sanitary Engineering II - Examination of water and waste water, water treatment, waste water treatment and special problems in public health, air pollution, and radioactivity. (3 s.h.)

251 Public Health Engineering - Engineering aspects involved in control of the environment for the protection of health and promotion of comfort of man. (3 s.h.)

252 Water Resources Engineering - Design of water resources systems. (3 s.h.)

345 Properties of Air Pollutants - Physical, chemical, biological, and social behavioral properties of dusts, droplets, and gases in the atmosphere. (3 s.h.)

349 Solid Waste Disposal - Study of traditional patterns and problems of solid waste storage, transport, and disposal. Examination of various engineering alternatives with appropriate consideration for air and water pollution control and land reclamation. (3 s.h.)

350 Sanitary Chemistry and Biology - Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. (3 s.h.)

356 Principles of Biological Waste Treatment - Examination of biological systems used in waste treatment as to ecology and function. (3 s.h.)

446 Air Pollution Control Engineering - Study of engineering alternatives in achieving various degrees of air pollution control. (3 s.h.)

447 Air Pollution Control Standards - Comparative study of technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. (3 s.h.)

452 Water Treatment Theory - Theory of various procedures and techniques utilized in treatment of water for municipal and industrial use. (3 s.h.)

454 Industrial and Advanced Waste Treatment - Basic physical and chemical operations used in industrial and advanced waste treatment; applications for waste water reclamation and reuse; study of industrial wastes from standpoint of process, source, and treatment. (3 s.h.)

455 Municipal and Industrial Design of Solid Wastes Disposal Operations - Design criteria of existing methods and equipment for disposal of solid wastes generated by industry and municipalities: on-site preparation. (3 s.h.)

457 Hydraulics of Sanitary Engineering Works - Techniques of population growth estimation, rainfall and runoff analysis, flood flow, and ground water data to the design of sanitary works. (3 s.h.)

458 Design of Sanitary Works - Water supply and waste water disposal problems. (3 s.h.)

INSTITUTION: WILSON COUNTY TECHNICAL INSTITUTE

PROGRAM: Sanitary Landfill Operating Manager

DEPARTMENT: Trades and Industries

DEGREE: Operator Certificate
Operator - Manager Diploma
Associate of Applied Science (A.A.S.)

CONTACT: Mr. George Howard, Head
Trades and Industries Department
Wilson County Technical Institute
902 Herring Avenue (P.O. Box 4305)
Wilson, North Carolina 27893
(919) 291-1195

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

These programs and the Sanitary Landfill Technology curriculum at the Wilson County Technical Institute are no longer functional. However, the programs were completely prepared, and were carried out during a portion of 1976. As such, program representatives believe that these have been the only programs of their kind in the country.

The operator certificate program was designed to last nine months, and to train persons to operate landfill equipment. Graduates of the twelve-month diploma program would be qualified to operate and manage disposal facilities. To train qualified people to operate landfill equipment, manage and operate disposal facilities, and to work as technicians in pollution abatement and environmental science with industry or governmental agencies, was a goal of the two-year A.A.S degree program.

The institute owns a trash master, and the students in the sanitary landfill programs had access to all of the machinery of the school's heavy equipment operator training program. The school also maintained an eighty acre area on the Wilson County landfill for operator training purposes.

Attempting to be sensitive to the work demands of sanitation employees in towns, cities and counties, the faculty was prepared to offer training with full-time day courses, evening courses, and weekend courses. In addition, for those facilities too distant to feasibly transport employees for training, faculty members offered to send instructors to these areas by sharing costs with the requesting bodies.

PROGRAM REQUIREMENTS

For a student to receive an operator certificate, fifty-seven quarter hours would be completed. Required courses included the areas of earth moving, draglining, blueprint reading, solid waste disposal, sanitary landfill operation, English and mathematics. As planned, in order to receive the operator-manager diploma, students would have to complete the above, as well as an additional nineteen hours with more English and mathematics as well as drafting, personnel management, and solid waste management. All students would receive on-site training at the landfill facility.

As planned, completion of the associate degree would require one hundred and nineteen quarter hours of credit, or fifty-two beyond the diploma. The complete curriculum includes thirty hours in heavy equipment operation, twenty-six hours in landfill operation and management, ten hours each in English and mathematics, six hours in business, eight hours in civil engineering technology, and seven hours in biology. Also included are courses in drafting, geography, chemistry, physics, ecology, and psychology. Many courses included provisions for on-site training at the landfill facility.

To be accepted into any curriculum at the Wilson County Technical Institute, applicants must submit an application, have a high school diploma or the equivalent (although in some cases this may be completed during the course of study at the institute), must have acceptable admission test scores, and must have a personal interview with an admissions counselor. There was no special financial assistance available for students enrolled in the sanitary landfill curriculum.

CURRENT FACULTY, STUDENTS, GRADUATES

One faculty member in a federally funded position was responsible for the coordination of all of the planned solid waste training programs on a full-time basis. An estimated fifteen faculty members assisted part-time in teaching the required classes. The coordinator is no longer with the school, and no courses are being taught in the field of solid waste.

Many recruitment efforts were carried out preceding the inception of the programs. These included talks to civic organizations and groups; advertisement through local radio stations and newspapers; visits to landfill operations; letters to county and city managers, and sanitation superintendents; and talks with other local officials and students. Six full-time and seven part-time students enrolled in the programs during the first quarter it was offered. All were either working in sanitary landfills or were enrolled in the school's heavy equipment operator training program. These persons received a special certificate for operation of the trash compactor from the heavy equipment operator training program, but did not continue with the landfill program. No additional students enrolled and the programs were discontinued.

The shortage of students is attributed in large part to the low pay scales within the landfill operations and the resultant high turnover rate. Local officials do not provide salaries commensurate with the level of training, and neither the officials nor their employees are willing to expend the money and/or effort required for the training.

PROGRAM PROJECTIONS

To re-offer these programs with a limited number of students would require additional funding, beyond state instructional funds. The school administration believes that there is a strong need for upgrading sanitary landfill operations and management skills through training, but feels that a mandatory operator certification law would have to be passed before training such as this would be taken advantage of. If such a law is passed and the student demand is enough to justify spending state money, or if outside funding is received, the program will once again be put into effect.

COURSE DESCRIPTION

LOM 101 Blueprint Reading: Civil - An introduction to the interpretation of basic blueprints used in civil engineering. (3 q.h.)

LOM 102 Introduction to Solid Waste Disposal - An introduction to solid waste disposal covering past and present methods. Emphasizes the 'what' and 'why' alterations are being made in former methods. Lab sessions in open dumps, landfills and other facilities. (3 q.h.)

LOM 103 Sanitary Landfill Design - Development of landfill design and operation plans which ensure safe, efficient disposal of projected quantities and types of solid waste. Volume requirements, site construction, equipment needs, fill methods, and pollution control. (4 q.h.)

LOM 104 Sanitary Landfill Operation - Logistics of traffic flow, unloading, compacting and covering material, maintenance, fire control, litter control, adverse weather operation, measurement procedures, and safety awareness. Operational experiences in heavy equipment operation and application of fundamental drainage theory. (5 q.h.)

LOM 105 Introduction to Solid Waste Management - The growing problems connected with the generation and disposal of solid wastes. The sources and types of refuse. Various kinds of collection and disposal systems. Field trips to landfill sites and field analysis of operation. (4 q.h.)

LOM 106 Introduction to Collection Procedures - An extension of management and operation courses with emphasis on collection procedures. Consideration of external factors and how they relate to collection systems. Labs in collection, transportation and routing. (4 q.h.)

LOM 107 Introduction to Incineration - Combustion theory and general facility design from on-site refuse receiving to the disposal of the ash residue. Considers the present basic systems with strong orientation toward operation and maintenance. Labs stress prevention of air, water, and land pollution as it relates to incineration. (3 q.h.)

CV 108 Basic Hydraulics: Principles of Flow - A study of closed conduit and open channel flow including stream flow, subterranean flow, runoff, pumphead and wave action. (4 q.h.)

ENV 210 Ecology - Relationships between organisms and their environment, and interactions among organisms. Environmental factors affecting aquatic and terrestrial systems. Lectures, laboratories, and field trips. (4 q.h.)

DFT 120 Topographic Drafting - Application of drawing techniques to land surveying, including boundaries, roads, buildings, and elevation. (4 q.h.)

HEO 101 Earth Moving Operations - Experience in the operation of the crawler tractor and dozer, motor scraper, and front end loader. Operator's preventive maintenance, safety, operating costs, basic surveying, and grade stake reading. Students to be proficient in one major and one or more minor piece of equipment. (15 q.h.)

HEO 105 Dragline I - Experiences in the operation of the dragline. Also operator's preventive maintenance, safety, operating costs, and basic surveying and grade stake reading. Students to be proficient in one major piece of equipment. (15 q.h.)

INSTITUTION: WILSON COUNTY TECHNICAL INSTITUTE

PROGRAM: Sanitary Landfill Technology
DEPARTMENT: Trades and Industries
DEGREE: Associate of Applied Science

CONTACT: Mr. George Howard, Head
Trades and Industries Department
Wilson County Technical Institute
902 Herring Avenue (P.O. Box 4305)
Wilson, North Carolina 27893
(919) 291-1195

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

This program was designed to be separate from the Sanitary Landfill Operating Manager programs at Wilson County Technical Institute, also discussed in this report. However, many overlaps occur with respect to faculty, facilities, fate and projections. As with the other programs, the Sanitary Landfill Technology program is not now offered.

This program was designed to last two years, and to provide knowledge and skills in the sanitary disposal of refuse. Were students to have completed the program, they should have been qualified to be employed as sanitary landfill inspectors, operators, managers, or technicians. Job requirements may have included testing the quality of land, air and water; advising municipal government officials in developing solid waste systems; and supervising solid waste operations.

PROGRAM REQUIREMENTS

As planned, completion of this associate degree program would require 112 quarter hours of credit. Twenty-six of these are in landfill operation and management, fifteen in math, thirteen in English, eight in drafting, eleven in civil engineering technology, nine in chemistry, seven in biology, and eight in physics. Other required courses are in the areas of business, geography, ecology, and psychology. On-site instruction would be provided at the eighty-acre area on the Wilson County landfill that was maintained by the school.

To be accepted into any curriculum at the Wilson County Technical Institute, applicants must submit an application and high school diploma or the equivalent (although in some cases this may be completed during the course of study at the institute), must have acceptable admission test scores, and must have a personal interview with an admissions counselor. There was no special financial assistance available for students enrolled in this program.

CURRENT FACULTY, STUDENTS, GRADUATES

One faculty member in a federally funded position was responsible for the coordination of all the planned sanitary landfill programs on a full-time basis. In addition, approximately fifteen faculty members contributed part-time teaching responsibilities. The coordinator is no longer with the school, and no courses are currently being taught in solid waste.

Preceding the program's inception, many student recruitment efforts were carried out. These are described in more detail in the summary of the Operating Manager programs. No students actually enrolled in the Sanitary Landfill Technology program. However, during the first quarter of the program's inception, late in 1976, thirteen students took courses in solid waste disposal, and received special certificates for operation of the trash compactor. None continued beyond this quarter, and all programs were ceased.

The shortage of students in these programs is attributed in large part to the low pay scales within landfill operations, and the resultant high turnover rates. Local officials do not provide salaries commensurate with the level of training, and neither the officials nor their employees are willing to expend the money and/or effort required with the training.

PROGRAM PROJECTIONS

The school's administration perceives a strong need for training of this nature to upgrade the skills of sanitary landfill personnel. However, with the limited number of students, additional funding would be required to continue the program, beyond state instructional funds. A mandatory certification law for landfill operators would force cities and counties to face the skill problem, and make provisions of this nature. If this occurs and student demand increases, or outside funding is received, the program will once again be put into effect.

COURSE DESCRIPTION

(For those with only course titles, course descriptions may be found in the summary of the Sanitary Landfill Operating Manager programs.)

CIV 202 Properties of Soils - Study of soil types and their physical properties; mechanical analysis and tests of soils; techniques of sub-surface investigation; earth pressure theories; bearing capacity; stability of slopes; hydrostatics of ground water; methods of compaction and consolidation. (3 q.h.)

DFT 101 Technical Drafting - An introductory study of drawing principles and practices for describing objects in the graphic language. Basic skills and techniques of drafting included are: use of drafting equipment, lettering, dimensioning practices; geometric construction; and orthographic drawing. (4 q.h.)

CHM 244 Environmental Chemistry - Fundamentals of environmental science, emphasizing the variables of energy, matter, space, time and diversity and their relationships. Efficiency of energy transfer in systems of major importance. (4 q.h.)

LOM 101 Blueprint Reading - Civil
LOM 102 Introduction to Solid Waste Disposal
LOM 103 Sanitary Landfill Design
LOM 104 Sanitary Landfill Operation
LOM 105 Introduction to Solid Waste Management
LOM 106 Introduction to Collection Procedures
LOM 107 Introduction to Incineration
CIV 101 Surveying I
CIV 108 Basic Hydraulics: Principles of Flow
DFT 120 Topographic Drafting
ENV 210 Ecology
GEO 110 Introduction to Physical Geography
BUS 233 Personnel Management
BUS 235 Business Management
BIO 110 Fundamentals of Microbiology

INSTITUTION: YALE UNIVERSITY

PROGRAM: Environmental Health

DEPARTMENT: Epidemiology and Public Health

DEGREE: Master of Public Health

CONTACT: Jan Adrianus Jozef Stolwijk, Ph.D.
Professor of Epidemiology (Environmental Health)
Yale University, School of Public Health
Department of Epidemiology and Public Health
60 College Street
New Haven, Connecticut 06510
(203) 562-9901

PROGRAM DESCRIPTION:

PROGRAM STRUCTURE

The John B. Pierce Laboratory has been affiliated with Yale University since its founding in 1924. Many of the Laboratory's staff hold joint appointments at the University, primarily in the Department of Epidemiology and Public Health. The Pierce Laboratory now conducts a major portion of Yale's program in environmental health. The Laboratory's staff of physiologists, psychologists, and engineers are well known internationally for their studies of how humans respond to the environment, particularly the thermal environment. They also conduct research in air sanitation, thermal physiology, and the mechanisms of related adverse health effects.

Epidemiological and toxicological studies are also conducted by laboratory staff in order to describe and accurately assess the effect of air pollutants on human health, in the occupational and community environment. An ongoing air sanitation research program is concerned with the measurement of acute adverse effects of air pollutants in the New Haven area. Recent research has found that when combined with the blood's capacity to transport oxygen to the body's tissues. The air sanitation laboratory has devices and tools for studies of human responses to air pollution. Air sanitation laboratory staff study the pulmonary function and resistance changes in man and animals resulting from breathing noxious materials and gases.

Yale University's Division of Environmental Health, started in 1967, is concerned with the study and management and control of natural and human caused factors in the environment in their relationship to human health and well-being. Emphasis in the program is placed in providing the students a broad and sound understanding of the source and characteristics of environmental factors and the mechanism of their interaction with people.

Students who participate in the Division of Environmental Health's programs are prepared for employment by governmental and service agencies and by industry. Environmental health graduates are expected to be able to participate in and/or direct the environmental health activities and operations of a governmental, service, or industrial organization. Many graduates become directors of health districts, environmental coordinators of state health departments, sanitarians, and other administrative positions. Governmental administrative positions often are in environmental and occupational health capacities. Others find positions in unions, industry, consulting (research and teaching) and with organizations such as the Environmental Defense Fund and the American Lung Associates.

PROGRAM REQUIREMENTS

The Department of Epidemiology of Public Health requires candidates for the Master of Public Health to possess, in order to be admitted, either: (1) a graduate degree, from an acceptable institution, in a discipline relevent to public health, or (2) a bachelor's degree from an acceptable institution, with a substantial knowledge in a discipline relevent to public health either through study or experience or a combination of these. Candidates are expected to have attained an undergraduate average of B.

Students who have not had prior course work in human physiology will be expected to take Epidemiology and Public Health 111A, The Human Body in Health and Disease. All students are expected to attend the weekly seminar in environmental physiology. For graduation, all students are expected to earn satisfactorily a minimum of sixty credits, including four credits for supervised field training and nine credits for the essay.

The Division of Environmental Health's eleven required courses provide an understanding of the basic interactions between people and their environment as well as an introduction to the control and management techniques. Elective courses give students opportunities to specialize in a selected area of environmental health.
The Division's curriculum is sufficiently flexible to accomplish this. Some students may specialize in the application of control and management techniques, particularly those methods pertaining to the engineering and sanitation aspects of the environment. Research work performed in conjunction with Environmental Health 213 Research in Environmental Health, provides study opportunities to do an in-depth study in a selected area of environmental health. Some of the advanced or specialized courses are taught on a tutorial or semi-tutorial basis with the program of instruction being geared to meet the student's specific needs or interests. Students are also encouraged in the program to elect appropriate courses in other departments and schools of Yale University.

A three month summer practicum is available to students in the program between the first and second years. It affords students an opportunity to obtain "hands on" experience and bring the training gained back to class to share. Students have been sponsored by the EPA, state and local health departments, television and newspaper media and the State of New York. Also, during the second year students participate in a one day per week practical work experience. In this they are assigned to an employed environmental health person one day a week at local or state health departments. Then they write an essay examining an environmental health problem.

The Department of Epidemiology and Public Health is a participant in the Graduate and Professional School Financial Aid Service and loans and grants are awarded on the basis of need. Two pre-doctorates and two post-doctorates fellowships are available to students in the program and the National Institutes of Health are the funding source. A number of partial traineeship support is also available from the Federal government for Master's students.

CURRENT FACULTY, STUDENTS, GRADUATES

Ten faculty members contribute to the teaching and research conducted by the Division of Environmental Health. It is estimated that about 25% of their time is devoted to teaching and 75% to research. All ten are entirely supported by research funding from the National Institutes of Health, the National Science Foundation, the National Aeronautics and Space Administration, the Air Force, the American Society for Health and Engineering and the General Foods Corporation. The National Institute for Environmental Health Science funds a grant for the Divisions training program.

A total of twenty students (50% female) are currently enrolled full-time. There are no part-time students enrolled in the Division's program. Ten students annually receive the Master of Public Health degree, on the average. The number of graduates and enrollment has remained stable.

This program is designed to be a terminal program as only the Master's degree is offered. Some students do continue for doctorates, M.D.s and law degrees, however. Most that continue for doctorates do so at schools which have environmental physiology or environmental health programs. Virtually all graduates obtain employment in their field and it is estimated that one-half enter positions in the private sector and the other one-half find jobs in the public sector. Most obtain occupational health positions.

PROGRAM PROJECTIONS

Although this program is not expected to significantly change in faculty staff size, enrollment or emphasis,additional continuing education package programs are likely to be developed. These programs will be designed for people already working in the field.

Additional administrative occupational health personnel will probably be recruited to teach community and occupational health courses. These personnel may already have positions as a director of a medical corporation, for example. Additional degree programs will not be developed because doctorates are already offered in the fields of epidemiology, and environmental biostatistics.

Professionals in the field foresee a slow and steady growth in the environmental health field. The new Toxic Substances Control Act requires an enormous need for testing in stages. They feel that this program would work better if expanded because research results could be obtained if the program is doubled. Even if the program was doubled, Yale professionals in the program do not feel that the market would be flooded in the environmental health field.

COURSE DESCRIPTION

100b Introduction to Air Pollution - Principal sources and causes of air pollution, the nature and behavior of air pollutants, the effects of air pollution, and the organization and administration of control measures. (1 s.h. first half term)

112a Water Supply and Waste Water Treatment - A study of the design and operation of water supply systems and waste water treatment systems. (2 s.h.)

113b Solid Waste Management - Consideration of the fundamentals of solid waste collection, storage, processing, and disposal. (1 s.h.)

120a Principles of Radiological Health - Basic problems and programs of environmental and occupational control of ionizing radiation. (1 s.h.)

150b Introduction to Environmental Control - A survey course in environmental control which identifies the various environmental entitities that affect or may affect health and discusses the various methods of control. (2 s.h.)

151 Seminar in Environmental Control and Management - Students and guest lecturers discuss current problems of environmental control and management. (1 s.h. each term)

153b Environmental Control in Community Hygiene I - Subject matter includes air pollution, solid waste, housing and vector control. (4 s.h.)

154a Environmental Control in Community Hygiene II - Subject matter includes water supply and waste water treatment, food and milk sanitation, ionizing radiation. (4 s.h.)

155 Readings in Environmental Health - Study and review of the literature in selected areas of environmental health with particular emphasis upon research and epidemiological studies. (2-4 s.h. each term)

162b Chemical Factors in the Environment - The health effects of air pollutants and their mechanisms of action will be discussed. Also included will be the discussion of excretion of such factors as pesticides, rodenticides, and hepatotoxic agents. (3 s.h.)

165b Sensory Responses to Physical and Chemical Factors in the Environment - Examines some of the health effects of pertinent biological factors of importance in environmental control activities. (3 s.h.)

166b Control of Hazardous Chemicals in the Environment - Occupational and community exposure to hazardous chemicals; threshold limit values, criteria documentation; OSHA regulations and other standards. (2 s.h.)

Photo reprinted from the Michigan
Technological University Catalog
1975-76

APPENDICES

Photo reprinted from the University
of Illinois Institute of Technology
Booklet

Photo reprinted from the
Indiana University of Public
and Environmental Affairs
Catalog 1977-78

APPENDIX I

DEGREE ABBREVIATIONS

APPENDIX I

Degree Abbreviations

A.A.	Associate of Arts
A.A.Ag.	Associate of (in) Applied Agriculture
A.Ag.	Associate of (in) Agriculture
A.A.P.C.T.	Associate Degree in Air Pollution Control Technology
A.A.S.	Associate of Applied Science
A.B.	Bachelor of Arts
A.D.	Associate Degree
A.E.T.	Associate in Engineering Technology
A.M.T.	Associate of Mining Technology
A.N.E.T.	Associate of Nuclear Engineering Technology
A.S.	Associate in Science
A.S.E.M.T.	Associate of Science in Engineering Mining Technology
A.T.	Associate of Technology
B.A.	Bachelor of Arts
B.E.M.T.	Bachelor of Engineering in Mining Technology
B.S.	Bachelor of Science
B.S. (N.E.)	Bachelor of Science in Nuclear Engineering
B.S. (N.E.S.)	Bachelor of Science (Nuclear Engineering Sciences)
B.S. (N.R.)	Bachelor of Science in Natural Resources
B.S.A.	Bachelor of Science in Agriculture
B.S.C.E.	Bachelor of Science in Civil Engineering
B.S.Ch.E.	Bachelor of Science in Chemical Engineering
B.S.E.	Bachelor of Science in Engineering
B.S.E.H.	Bachelor of Science in Environmental Health
B.S.E. (N.E.)	Bachelor of Science (Nuclear Engineering)
B.S.E.S.	Bachelor of Science in Engineering Sciences
B.S.N.E.	Bachelor of Science in Nuclear Engineering
B.T.	Bachelor of Technology
Cert.	Certificate

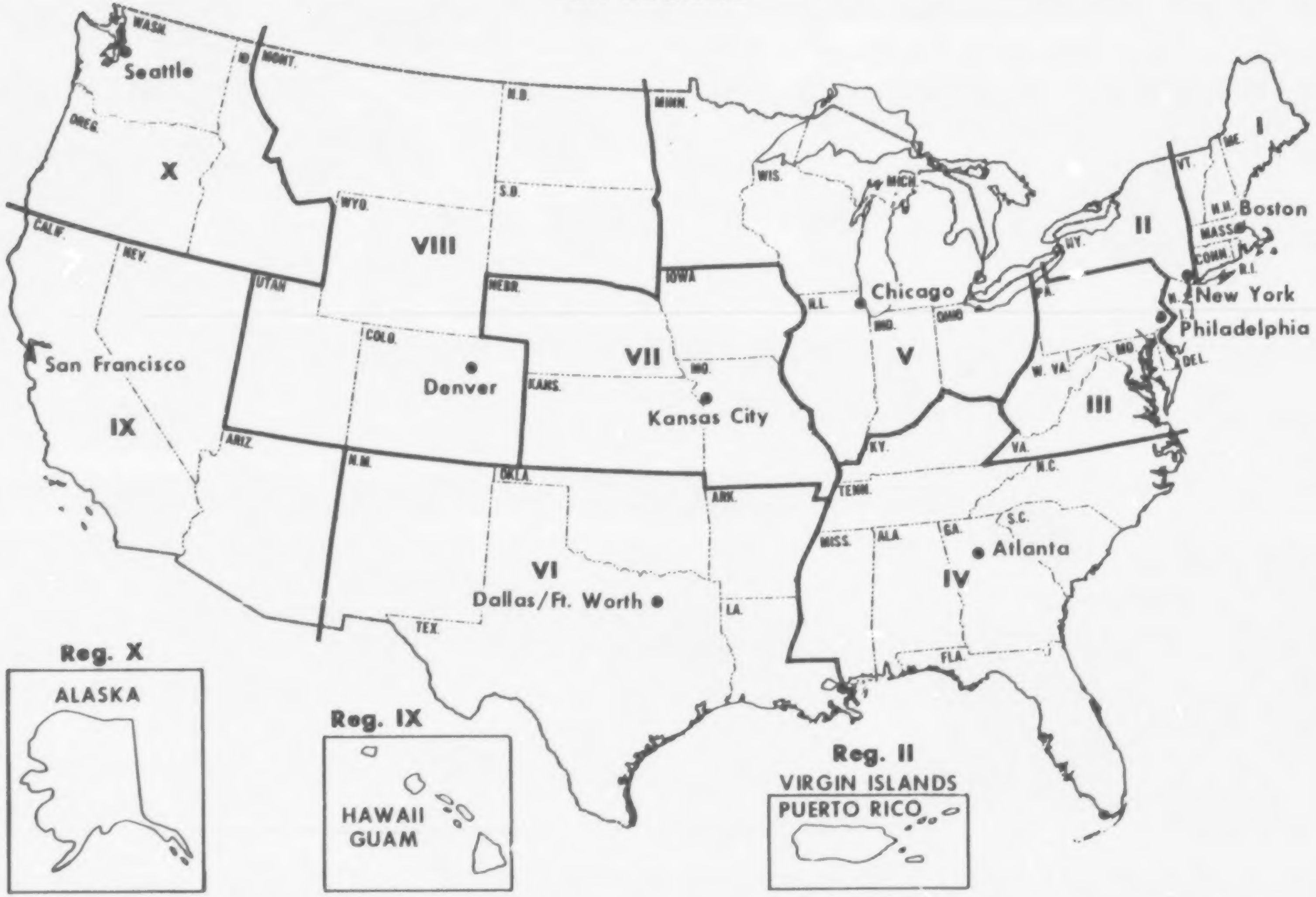
D.E.	Doctor of Engineering
D.P.H.	Doctor of Public Health
D.S.	Doctor of Science
D.S. (Hyg.)	Doctor of Science Hygiene
D.Sc.	Doctor of Science
Dr.P.H.	Doctor of Public Health
E.E.	Environmental Engineer
Eng.	Engineer
Engr.	Engineer
Engr.Sc.D.	Doctor of Engineering Science
Env.E.	Environmental Engineer
Envir.Eng.	Environmental Engineer
M.A.	Master of Arts
M.Ag.	Master of Agriculture
M.Agr.	Master of Agriculture
M.A.S.	Master of Applied Science
M.C.E.	Master of Civil Engineering
M.E.	Master of Engineering
M.E.E.E.	Master of Engineering in Environmental Engineering
M.E.A.S.	Master of Environmental Arts and Science
M.E.H.S.	Master of Environmental Health Sciences
M.E.M.	Master of Environmental Management
M.E.P.C.	Master in Environmental Pollution Control
M.Eng.	Master of Engineering
M.Engr.	Master of Engineering
M.F.	Master of Forestry
M.M.E.	Master of Mechanical Engineering
M.P.	Master of Philosophy
M.P.A.	Master of Public Affairs
M.P.H.	Master of Public Health
M.P.P.P.M.	Master of Plant Protection and Pest Management

M.P.S.	Master of Professional Studies
M.S.	Master of Science
M.S. (Hyg.)	Master of Science Hygiene
M.S.C.E.	Master of Science in Civil Engineering
M.S.Ch.E.	Master of Science in Chemical Engineering
M.S.E.	Master of Science in Engineering
M.S.E.E.	Master of Science in Environmental Engineering
M.S.En.E.	Master of Science in Environmental Engineering
M.S.Eng. S.	Master of Science in Environmental Engineering
M.S.Eng. Sci.	Master of Science in Engineering Science
M.S.E.H.	Master of Science in Environmental Health
M.S.E.M.P.	Master of Science in Energy Management and Policy
M.S.E.S.	Master of Science in Environmental Science (Studies)
M.S.P.H.	Master of Science in Public Health
M.S.(S.E.)	Master of Science in Sanitary Engineering
M.S.(S.S.)	Master of Science in Sanitary Science
N.E.	Nuclear Engineering
Nuc. Eng.	Nuclear Engineering
Ph.D.	Doctor of Philosophy
S.B.	Bachelor of Science
Sc.D.	Doctor of Science
S.M.	Master of Science

APPENDIX II

TERMINOLOGY

STANDARD REGIONAL BOUNDARIES
TEN REGIONS


I
II
III
IV
V
VI
VII
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IX
X
Seattle
San Francisco
Denver
Kansas City
Chicago
Dallas/Ft. Worth
Atlanta
Boston
New York
Philadelphia
WASH.
ID.
MONT.
N.D.
MINN.
OREG.
WIS.
MICH.
ME.
VT.
N.H.
MASS.
CONN.
R.I.
N.Y.
N.J.
PA.
DEL.
MD.
W. VA.
VA.
OHIO
IND.
ILL.
IOWA
NEBR.
WYO.
S.D.
CALIF.
NEV.
UTAH
COLO.
KANS.
MO.
KY.
TENN.
N.C.
S.C.
GA.
ALA.
MISS.
ARK.
LA.
OKLA.
TEX.
N.M.
ARIZ.
FLA.
Reg. X
ALASKA
Reg. IX
HAWAII
GUAM
Reg. II
VIRGIN ISLANDS
PUERTO RICO

TERMINOLOGY

ACT (American College Testing) and SAT (Scholastic Aptitude Test) - Standardized examinations which are intended to provide applicants and institutions with a numerical statement of an individual's ability and readiness to successfully complete college/university level work.

Co-op program - A plan whereby a student receives financial assistance and academic credit under the direction of a cooperating employment site representative and a faculty advisor in exchange for an agreed upon condition of employment. Students must complete all degree requirements as per the norm.

Course - For the purpose of this study, a course is considered a unit of a program, in which a body of knowledge is presented, the satisfactory completion of which leads to the awarding of a predetermined or individually arranged number of credits.

ECPD (Engineers' Council for Professional Development) - Accrediting body for programs in engineering technology.

ERIC (Educational Resources Information Center) - A national information system designed and developed by the U.S. Office of Education, and now supported and operated by the National Institute of Education (NIE), for providing ready access to descriptions of exemplary programs, research and development efforts, and related information that can be used in developing more effective educational programs.

GRE (Graduate Record Examination) - (General Aptitude) An examination of verbal and mathematical competency and aptitude, which is designed to provide a numerical indication of an individual's ability to successfully complete advanced level work. For the purposes of the study, the GRE will not refer to the Advanced Examinations.

Internship/Applied Study Term - An arrangement which is intended to provide a simulation of work experience under the direction of academic advisors and is designed to be an integral segment of an individual's academic program. (College credit may be given.)

IRIS (Instructional Resources Information System) - A computerized information base listing materials relating to education and training in the water quality control field, which is located in the National Training and Operational Technology Center of the U.S. Environmental Protection Agency.

MEDLINE - Computerized literature search services with application to medical information.

NTIS (National Technical Information Service) - Computerized literature search services.

Program - For the purpose of this study, a plan of study, either completely prescribed, or containing options, with an identity of its own, and standard rules and procedures, the satisfaction of which may lead to a degree, certificate, or diploma.

Quarter hours - vs. - Semester hours - One semester hour is the credit equivalent to one and a half quarter hours.

Standard Federal Boundaries - Geographic division of the United States for the purposes of decentralized administration; in this report also referred to as EPA regions (see map on preceding page).

TOXLINE - Computerized literature search services with particular application to the recall of information concerning toxic substances.

WRSIC (Water Resources Scientific Information Center) - Collects, screens, organizes and disseminates reports in water resources.

APPENDIX III

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

Articles and Periodicals

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APPENDIX IV

PARTICIPATING INSTITUTIONS
BY
ENVIRONMENTAL CATEGORY

APPENDIX IV

PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
AIR	Carnegie-Mellon University	Pittsburgh, PA
	Clemson University	Clemson, SC
	Drexel University	Philadelphia, PA
	George Washington University-NASA	Hampton, VA
	Harvard University School of Public Health	Boston, MA
	Hudson Valley Community College	Troy, NY
	Massachusetts Institute of Technology	Ithaca, NY
	Michigan Technological University	Houghton, MI
	Middlesex County College	Edison, NJ
	Muskingum Area Technical College	Zanesville, OH
	New Jersey Institute of Technology	Newark, NJ
	North Carolina State University	Chapel Hill, NC
	North Dakota State School of Science	Wahpeton, ND
	Northeastern University	Boston, MA
	Ohio State University	Columbus, OH
	Portland State University	Portland, OR
	Prairie State Community College	Chicago Heights, IL
	Purdue University	West Layfayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rutgers-The State University of New Jersey	New Brunswick, NJ
	Springfield Technical Community College	Springfield, MA
	Stevens Institute of Technology	Hoboken, NJ
	Sumter University	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	The Pennsylvania State University	University Park, PA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Florida	Gainesville, FL
	University of Iowa	Iowa City, IA
	University of Kentucky	Lexington, KY
	University of Maryland	College Park, MD
	University of Michigan	Ann Arbor, MI
	University of Missouri-Rolla	Rolla, MO
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Texas-Austin	Austin, TX
	University of Washington	Seattle, WA
	University of Wisconsin-Milwaukee	Milwaukee, WI
	Vanderbilt University	Nashville, TN
	Washington State University	Pullman, WA
	Washington University	St. Louis, MO
	West Virginia University	Morgantown, WV
	Yale University	New Haven, CT

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
COMPOSITE:	Antioch College	Yellow Springs, OH
	Baylor University	Waco, TX
	Bemidji State University	Bemidji, MN
	California Institute of Technology	Pasadena, CA
	California Polytechnic State University	San Luis Obispo, CA
	Catholic University of America	Washington, DC
	Carnegie-Mellon University	Pittsburgh, PA
	Chattanooga State Technical Community College	Chattanooga, TN
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Cornell University	Ithaca, NY
	Delaware Technical and Community College	Newark, DE
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	Duke University	Durham, NC
	East Central Oklahoma State University	Ada, OK
	East Tennessee State University	Johnson City, TN
	Evergreen State College	Olympia, WA
	Ferris State College	Big Rapids, MI
	Florida International University	Miami, FL
	Georgia Institute of Technology	Atlanta, GA
	Heed University	Hollywood, FL
	Hocking Technical College	Nelsonville, OH
	Howard University	Washington, DC
	Hunter College	New York, NY
	Indiana University	Bloomington, IN
	Iowa State University	Ames, IA
	Johns Hopkins University	Baltimore, MD
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Lamar University	Beaumont, TX
	Macalester College	St. Paul, MN
	Massachusetts Institute of Technology	Cambridge, MA
	McNeese State University	Lake Charles, LA
	Miami University	Oxford, OH
	Michigan State University	East Lansing, MI
	Middle Tennessee State University	Murfreesboro, TN
	Morehead State University	Morehead, KY
	Muskingum Area Technical College	Zanesville, OH
	New Jersey Institute of Technology	Newark, NJ
	North Carolina State University	Raleigh, NC
	Northland College	Ashland, WI
	Ohio State University	Columbus, OH

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
OMPOSITE: (Cont'd)	Ohio University	Athens, OH
	Oscar Rose Junior College	Midwest City, OK
	OSU Oklahoma City Technical Institute	Oklahoma City, OK
	Polytechnical Institute of New York	Brooklyn, NY
	Princeton University	Princeton, NJ
	Purdue University	West Lafayette, IN
	Raymond Walters General and Technical College (University of Cincinnati	Cincinnati, OH
	Rensselaer Polytechnical Institute	Troy, NY
	Rutgers University	New Brunswick, NJ
	Sam Houston State University	Huntsville, TX
	Sangamon State University	Springfield, IL
	Slippery Rock State College	Slippery Rock, PA
	Springfield Technical and Community College	Springfield, MA
	Stevens Institute of Technology	Hoboken, NJ
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas A & M University	College Station, TX
	The Cooper Union	New York, NY
	The Pennsylvania State University	University Park, PA
	University of Alabama	University, AL
	University of Alaska	Fairbanks, AK
	University of Arkansas	Fayetteville, AR
	University of California-Santa Barbara	Santa Barbara, CA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Florida	Gainesville, FL
	University of Georgia	Athens, GA
	University of Kansas	Lawrence, KS
	University of Louisville	Louisville, KY
	University of Maine-Orono	Orono, Maine
	University of Michigan	Ann Arbor, MI
	University of Minnesota	Minneapolis, MN
	University of North Carolina	Chapel Hill, NC
	University of Oklahoma	Norman, OK
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Toledo	Toledo, OH
	University of Utah	Salt Lake City, UT
	University of Washington	Seattle, WA
	University of Wisconsin-Green Bay	Green Bay, WI
	University of Wisconsin-Madison	Madison, WI
	Utah State University	Logan, UT

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
COMPOSITE: (Cont'd)	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Washington State University	Pullman, WA
	Western Kentucky University	Bowling Green, KY
	Western Washington University (Huxley College of Environmental Studies)	Bellingham, WA
	West Virginia University	Morgantown, WV
	Yale University	New Haven, CT
ENERGY:	Bluefield State College	Bluefield, WV
	Brigham Young University	Provo, UT
	Carnegie-Mellon University	Pittsburgh, PA
	Columbia University	New York, NY
	Cornell University	New York, NY
	Georgia Institute of Technology	Atlanta, GA
	Hartford State Technical College	Hartford, CT
	Kansas State University	Manhattan, KS
	Lamar University	Beaumont, TX
	Massachusetts Institute of Technology	Cambridge, MA
	Morehead State University	Morehead, KY
	Muskingum Area Technical College	Zanesville, OH
	Oregon State University	Corvallis, OR
	Pikeville College	Pikeville, KY
	Polytechnic Institute of New York	Brooklyn, NY
	Princeton University	Princeton, NJ
	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Southern Technical Institute	Marietta, GA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Kentucky	Lexington, KY
	University of New Mexico	Albuquerque, NM
	University of Pennsylvania	Philadelphia, PA
	University of Tennessee	Knoxville, TN
	West Virginia Institute of Technology	Montgomery, WV
	West Virginia University	Morgantown, WV

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
NOISE:	George Washington University-NASA	Hampton, VA
	Georgia Institute of Technology	Altanta, GA
	Massachusetts Institute of Technology	Cambridge, MA
	Memphis State University	Memphis, TN
	North Carolina State University	Raleigh, NC
	The Pennsylvania State University	University Park, PA
	University of Cincinnati	Cincinnati, OH
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
	University of Tennessee Center for Health Sciences	Memphis, TN
PESTICIDES:	Abraham Baldwin Agricultural College	Tifton, GA
	Broward Community College	Ft. Lauderdale, FL
	Central Technical Community College	Hastings, NE
	Delgado Community College	New Orleans, LA
	Harvard University School of Public Health	Boston, MA
	Mississippi State University	Mississippi State, MS
	New Mexico State University	Las Cruces, NM
	North Carolina State University	Raleigh, NC
	Ohio State University	Columbus, OH
	Oregon State University	Corvallis, OR
	Rutgers State University of New Jersey	New Brunswick, NJ
	State University of New York at Farmingdale	Farmingdale, NY
	Texas A & M University	College Station, TX
	The Pennsylvania State University	University Park, PA
	University of California-Berkeley	Berkeley, CA
	University of California-Davis	Davis, CA
	University of California-Riverside	Riverside, CA
	University of Cincinnati	Cincinnati, OH
	University of Delaware	Newark, DE
	University of Georgia	Athens, GA
	University of Iowa	Iowa City, IA
	University of Maryland	College Park, MD
	University of New Hampshire	Durham, NH
	University of Pittsburgh	Pittsburgh, PA
	University of Rochester	Rochester, NY
	Utah State University	Logan, UT

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
POTABLE WATER:	Atlanta University Center/Georgia Institute of Technology	Atlanta, GA
	Brigham Young University	Provo, UT
	California State University	Sacramento, CA
	Carnegie-Mellon University	Pittsburgh, PA
	Casper College	Casper, WY
	Central Technical Community College	Hastings, NE
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Colorado State University	Fort Collins, CO
	Community College of Denver-Red Rocks	Golden, CO
	Cornell University	Ithaca, NY
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	East Maine Vocational Technical Institute	Bangor, ME
	Hudson Valley Community College	Troy, NY
	Illinois Institute of Technology	Chicago, IL
	Iowa State University	Ames, IA
	J. Sargeant Reynolds Community College	Richmond, VA
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Linn-Benton Community College	Albany, OR
	Manhattan College	New York, NY
	Marquette University	Milwaukee, WI
	Massachusetts Institute of Technology	Cambridge, MA
	Miami-Dade Community College	Miami, FL
	Michigan Technological University	Houghton, MI
	Middlesex Community College	Edison, NJ
	Missouri Southern State College	Joplin, MO
	Montana State University	Bozeman, MT
	Muskingum Area Technical College	Zanesville, OH
	Northeastern University	Boston, MA
	Northern Montana College	Havre, MT
	Ohio State University	Columbus, OH
	Operator Training Center	Murfreesboro, TN
	Oregon Institute of Technology	Klamath Falls, OR
	Oscar Rose Junior College	Midwest City, OK
	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rice University	Houston, TX
	Rochester Institute of Technology	Rochester, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	Southern Illinois University	Edwardsville, IL

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
POTABLE WATER: (Cont'd)	Springfield Technical Community College	Springfield, MA
	Stanford University	Stanford, CA
	State University of New York at Buffalo	Buffalo, NY
	Stevens Institute of Technology	Hoboken, NJ
	Sumter Technical Community College	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	The Pennsylvania State University/ Capitol Campus	Middletown, PA
	Tufts University	Boston, MA
	Ulster County Community College	Stone Ridge, NY
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Hawaii	Honolulu, HI
	University of Iowa	Iowa City, IA
	University of Kansas	Lawrence, KS
	University of Kentucky	Lexington, KY
	University of Maine at Orono	Orono, ME
	University of Michigan	Ann Arbor, MI
	University of Missouri-Columbia	Columbia, MO
	University of Missouri-Rolla	Rolla, MO
	University of Nebraska	Lincoln, NE
	University of North Carolina	Chapel Hill, NC
	University of Pennsylvania	Philadelphia, PA
	University of Pittsburgh	Pittsburgh, PA
	University of Rhode Island	Kingston, RI
	University of Tennessee	Knoxville, TN
	University of Texas-Austin	Austin, TX
	University of Wisconsin-Madison	Madison, WI
	University of Wyoming	Laramie, WY
	Utah State University	Logan, UT
	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Water and Wastewater Technical School	Neosho, MO
	West Georgia College	Carrollton, GA
	West Virginia University	Morgantown, WV
	Wytheville Community College	Wytheville, VA

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
RADIATION:	Central Florida Community College	Ocala, FL
	Chattanooga State Technical Community College	Chattanooga, TN
	Columbia University	New York, NY
	Cornell University	Ithaca, NY
	Hartford State Technical College	Hartford, CT
	Harvard University School of Public Health	Boston, MA
	Kansas State University	Manhattan, KS
	Massachusetts Institute of Technology	Cambridge, MA
	Memphis State University	Memphis, TN
	Missouri Southern State College	Joplin, MO
	Oak Ridge Associated Universities	Oak Ridge, TN
	Oklahoma State University	Stillwater, OK
	Rensselaer Polytechnic Institute	Troy, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	St. Louis Community College at Forest Park	St. Louis, MO
	Southern Technical Institute	Marietta, GA
	The Pennsylvania State University	University Park, PA
	University of Florida	Gainesville, FL
	University of Kansas	Lawrence, KS
	University of Lowell	Lowell, MA
	University of Maryland	College Park, MD
	University of Michigan	Ann Arbor, MI
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Tennessee	Knoxville, TN
SOLID WASTE:	Carnegie-Mellon University	Pittsburgh, PA
	Clarkson College	Potsdam, NY
	Cornell University	New York, NY
	Drexel University	Philadelphia, PA
	Hofstra University	Hempstead, NY
	Michigan Technological University	Houghton, MI
	Rensselaer Polytechnic Institute	Troy, NY
	Temple University	Philadelphia, PA
	The Pennsylvania State University	University Park, PA
	University of Iowa	Iowa City, IA
	University of Missouri-Rolla	Rolla, MO
	University of Pittsburgh	Pittsburgh, PA
	Vanderbilt University	Nashville, TN
	West Virginia University	Morgantown, WV
	Wilson County Technical Institute	Wilson, NC
	Yale University	New Haven, CT

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
ASTEWATER:	Atlanta University Center/ Georgia Institute of Technology	Atlanta, GA
	Brigham Young University	Provo, UT
	California State University-Sacramento	Sacramento, CA
	Carnegie-Mellon University	Pittsburgh, PA
	Casper College	Casper, WY
	Central Technical Community College	Hastings, NE
	Charles County Community College	La Plata, MD
	Clarkson College	Potsdam, NY
	Clemson University	Clemson, SC
	Colorado State University	Fort Collins, CO
	Community College of Denver-Red Rocks	Golden, CO
	Cornell University	Ithaca, NY
	Delgado College	New Orleans, LA
	Drexel University	Philadelphia, PA
	East Maine Vocational Technical Institute	Bangor, ME
	Greenville Technical College	Greenville, SC
	Harvard University	Cambridge, MA
	Hudson Valley Community College	Troy, NY
	Illinois Institute of Technology	Chicago, IL
	Iowa State University	Ames, IA
	J. Sargeant Reynolds Community College	Richmond, VA
	Kansas State University	Manhattan, KS
	Kirkwood Community College	Cedar Rapids, IA
	Linn-Benton Community College	Albany, OR
	Manhattan College	New York, NY
	Marquette Technical University	Milwaukee, WI
	Massachusetts Institute of Technology	Cambridge, MA
	Miami-Dade Community College	Miami, FL
	Michigan Technological University	Houghton, MI
	Middlesex County College	Edison, NJ
	Missouri Southern State College	Joplin, MO
	Montana State University	Bozeman, MT
	Muskingum Area Technical College	Zanesville, OH
	New England Regional Wastewater Institute	S. Portland, ME
	New Jersey Institute of Technology	Newark, NJ
	Northeastern University	Boston, MA
	Northern Montana College	Havre, MT
	Ohio State University	Columbus, OH
	Operator Training Center	Murfreesboro, TN
	Oregon Institute of Technology	Klamath Falls, OR
	Oscar Rose Junior College	Midwest City, OK

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PARTICIPATING INSTITUTIONS BY ENVIRONMENTAL CATEGORY

CATEGORY	INSTITUTION	LOCATION
WASTEWATER: (Cont'd)	Purdue University	West Lafayette, IN
	Rensselaer Polytechnic Institute	Troy, NY
	Rice University	Houston, TX
	Rochester University	Rochester, NY
	Rutgers State University of New Jersey	New Brunswick, NJ
	Southern Illinois University	Edwardsville, IL
	Springfield Technical and Community College	Springfield, MA
	Stanford University	Stanford, CA
	State Technical Institute at Memphis	Memphis, TN
	State University of New York-Buffalo	Buffalo, NY
	Stevens Institute of Technology	Hoboken, NJ
	Sumter Technical Community College	Sumter, SC
	Syracuse University	Syracuse, NY
	Temple University	Philadelphia, PA
	Texas State Technical Institute	Waco, TX
	The Pennsylvania State University	University Park, PA
	The Pennsylvania State University/ Capitol Campus	Middletown, PA
	Tufts University	Boston, MA
	Ulster County Community College	Stone Ridge, NY
	University of California-Berkeley	Berkeley, CA
	University of Florida	Gainesville, FL
	University of Hawaii	Honolulu HI
	University of Kansas	Lawrence, KS
	University of Kentucky	Lexington, KY
	University of Lowell	Lowell, MA
	University of Maine at Orono	Orono, ME
	University of Missouri-Columbia	Columbia, MO
	University of Missouri-Rolla	Rolla, MO
	University of Nebraska	Lincoln, NE
	University of North Carolina	Chapel Hill, NC
	University of Pittsburgh	Pittsburgh, PA
	University of Rhode Island	Kingston, RI
	University of Tennessee	Knoxville, TN
	University of Texas	Austin, TX
	University of Wisconsin-Madison	Madison, WI
	University of Wyoming	Laramie, WY
	Utah State University	Logan, UT
	Vanderbilt University	Nashville, TN
	Virginia Polytechnic Institute and State University	Blacksburg, VA
	Water and Wastewater Technical School	Neosho, MO
	West Georgia College	Carrollton, GA
	West Virginia University	Morgantown, WV
	Wytheville Community College	Wytheville, VA

APPENDIX V

COLLEGE CATALOGS REVIEWED

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
AL	Alabama A & M University	Huntsville
	Alabama Christian College	Montgomery
	Alabama Lutheran Junior College	Selma
	Alexander City State Junior College	Alexander City
	Athens State College	Athens
	Auburn University	Auburn
	Auburn University at Montgomery	Montgomery
	Birmingham-Southern College	Birmingham
	Brewer State Junior College	Fayette
	Enterprise State Junior College	Enterprise
	Faulkner State Junior College	Bay Minette
	Gadsden State Junior College	Gadsden
	George C. Wallace State Community College	Dothan
	George C. Wallace State Community College	Selma
	Jacksonville State University	Jacksonville
	Jefferson Davis State Junior College	Brewton
	Jefferson State Junior College	Birmingham
	John C. Calhoun State Community College	Decatur
	Judson College	Marion
	Livingston University	Livingston
	Lawson State Community College	Birmingham
	Lurleen B. Wallace State Junior College	Andalusia
	Marion Military Institute	Marion
	Miles College	Birmingham
	Mobile College	Mobile
	Northeast Alabama State Junior College	Rainsville
	Northwest Alabama State Junior College	Phil Campbell
	Oakwood College	Huntsville
	Samford University	Birmingham
	Selma University	Selma
	Snead State Junior College	Boaz
	Southeastern Bible College	Birmingham
	Southern Benedictine College	Saint Bernard
	Southern Union State Junior College	Wadley
	Spring Hill College	Mobile
	Stillman College	Tuscaloosa
	Talladega College	Talladega
	Troy State University	Troy
	Tuskeegee Institute	Tuskeegee Institute
	University of Alabama	University
	University of Alabama in Birmingham	Birmingham
	University of Alabama in Huntsville	Huntsville
	University of Montevallo	Montevallo
	University of North Alabama	Florence
	University of South Alabama	Mobile
	Walker College	Jasper
AK	Sheldon Jackson College	Sitka
	University of Alaska-Fairbanks	Fairbanks
	University of Alaska Juneau Senior College	Juneau
AS	American Samoa Community College	Pago Pago
AZ	American Graduate School of International Management	Glendale
	Arizona State University	Tempe
	Arizona Western College	Yuma

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Central Arizona College	Coolidge
	Cochise College	Douglas
	College of Ganado	Ganado
	DeVry Institute of Technology	Phoenix
	Eastern Arizona College	Thatcher
	Grand Canyon College	Phoenix
	Maricopa County Community College System Office	Phoenix
	Glendale Community College	Glendale
	Maricopa Technical Community College	Phoenix
	Mesa Community College	Mesa
	Phoenix College	Phoenix
	Scottsdale Community College	Scottsdale
	Mohave Community College	Kingman
	Navajo Community College	Tsaile
	Northern Arizona University	Flagstaff
	Northland Pioneer College	Holbrook
	Pima Community College	Tucson
	Southwestern College	Phoenix
	University of Arizona	Tucson
	Yavapai College	Prescott
AR	Arkansas College	Batesville
	Arkansas State University-Main Campus	State University
	Arkansas State University-Beebe Branch	Beebe
	Arkansas Tech University	Russellville
	Central Baptist College	Conway
	College of the Ozarks	Clarksville
	Crowley's Ridge College	Paragould
	Garland County Community College	Hot Springs
	Harding College-Main Campus	Searcy
	Henderson State University	Arkadelphia
	Hendrix College	Conway
	John Brown University	Siloam Springs
	Mississippi County Community College	Blytheville
	Quachita Baptist University	Arkadelphia
	Philander Smith College	Little Rock
	Phillips County Community College	Helena
	Southern Arkansas University	Magnolia
	Southern Arkansas University Southwest Technical Institute	East Camden
	Southern Baptist College	Walnut Ridge
	Southern State College	Magnolia
	University of Arkansas-Main Campus	Fayetteville
	University of Arkansas-Little Rock	Little Rock
	University of Arkansas Medical Sciences Campus	Little Rock
	University of Arkansas-Monticello	Monticello
	Westlark Community College	Fort Smith
CA	Allan Hancock College	Santa Maria
	Ambassador College	Pasadena
	American Baptist Seminary of the West-Central Office	Berkeley
	American Baptist Seminary of the West-Covina	Covina
	Armstrong College	Berkeley
	Azusa Pacific College	Azusa
	Bakersfield College	Bakersfield
	Barstow College	Barstow
	Bauder College	Sacramento
	Bethany Bible College	Santa Cruz
	Biola College	La Mirada
	Brooks College	Long Beach

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Brooks Institute of Santa Barbara	Santa Barbara
	Butte College	Oroville
	Cabrillo College	Aptos
	California Baptist College	Riverside
	California College of Arts and Crafts	Oakland
	California Institute of the Arts	Valencia
	California Institute of Asian Studies	San Francisco
	California Institute of Technology	Pasadena
	California Lutheran College	Thousand Oaks
	California Maritime Academy	Vallejo
	California State College-San Bernadino	San Bernardino
	California State College-Stanislaus	Turlock
	California Polytechnic State University-San Luis Obispo	San Luis Obispo
	California State University-Fresno	Fresno
	California State University-Fullerton	Fullerton
	California State University-Hayward	Hayward
	California State University-Long Beach	Long Beach
	California State University-Los Angeles	Los Angeles
	California State University-Sacramento	Sacramento
	San Diego State University	San Diego
	San Jose State University	San Jose
	Cerritos College	Norwalk
	Cerro Coso Community College	Ridgecrest
	Chapman College	Orange
	Christian Heritage College	El Cajon
	Church Divinity School of the Pacific	Berkeley
	Citrus College	Azusa
	Claremont Colleges-System Office	Claremont
	Claremont Men's College	Claremont
	Claremont University Center and Graduate School	Claremont
	Harvey Mudd College	Claremont
	Pitzer College	Claremont
	Pomona College	Claremont
	Scripps College	Claremont
	Coast Community College-System Office	Costa Mesa
	Golden West College	Huntington Beach
	Orange Coast College	Costa Mesa
	Cogswell College	San Francisco
	Colegio De La Tierra	Goshen
	College of the Canyons	Valencia
	College of the Desert	Palm Desert
	College of Marin	Kentfield
	College of Notre Dame	Belmont
	College of the Redwoods	Eureka
	College of the Siskiyous	Weed
	Columbia Junior College	Columbia
	Compton Community College	Compton
	Contra Costa Community College-System Office	
	Diablo Valley College	Pleasant Hill
	Cuesta College	San Luis Obispo
	Cypress College	Cypress
	Dominican College of San Rafael	San Rafael
	El Camino College	Torrance
	Foothill-De Anza Community College District-System Office	Los Altos Hills
	De Anza College	Cupertino
	Foothill College	Los Altos Hills
	Fuller Theological Seminary	Pasadena
	Gavilan College	Gilroy
	Glendale Community College	Glendale
	Golden Gate University	San Francisco
	Grossmont College	El Cajon
	Hartnell College	Salinas
	Holy Family College	Mission San Jose

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Holy Names College	Oakland
	Immaculate Heart College	Los Angeles
	Indian Valley Colleges	Novato
	John F. Kennedy University	Orinda
	Lake Tahoe Community College	S. Lake Tahoe
	Lassen College	Susanville
	LaVerne College	La Verne
	L.I.F.E. Bible College	Los Angeles
	Lincoln University	San Francisco
	Lone Mountain College	San Francisco
	Long Beach City College	Long Beach
	Los Angeles Baptist College	Newhall
	Los Angeles Community College-System Office	Los Angeles
	East Los Angeles College	Los Angeles
	Los Angeles City College	Los Angeles
	Los Angeles Harbor College	Wilmington
	Los Angeles Mission College	San Fernando
	Los Angeles Pierce College	Woodland Hills
	Los Angeles Southwest College	Los Angeles
	Los Angeles Valley College	Van Nuys
	West Los Angeles College	Culver City
	Los Rios Community College-System Office	Sacramento
	Cosumnes River College	Sacramento
	Sacramento City College	Sacramento
	Loyla Marymount University	Los Angeles
	Marymount Palos Verdes College	Rancho Palos Verdes
	Mendocino College	Ukiah
	Menlo College	Menlo Park
	Mennonite Brethren Biblical Seminary	Fresno
	Merced College	Merced
	Mills College	Oakland
	Monterey Institute for Foreign Studies	Monterey
	Monterey Peninsula College	Monterey
	Mount San Antonio College	Walnut
	Mount San Jacinto College	San Jacinto
	Napa College	Napa
	National University	San Diego
	New College of California	San Francisco
	Northrop University	Inglewood
	Occidental College	Los Angeles
	Ohlone College	Fremont
	Otis Art Institute of Los Angeles County	Los Angeles
	Pacific Christian College	Fullerton
	Pacific College	Fresno
	Pacific Oaks College	Pasadena
	Pacific School of Religion	Berkeley
	Pacific Union College	Angwin
	Palomar College	San Marcos
	Palo Verde College	Blythe
	Pasadena City College	Pasadena
	Patten Bible College	Oakland
	Pepperdine University	Malibu
	Peralta Community Colleges-System Office	Oakland
	College of Alameda	Alameda
	Point Loma College	San Diego
	Porterville College	Porterville
	Rand Graduate Institute of Policy Studies	Santa Monica
	Riverside City College	Riverside
	Rosemead Graduate School of Psychology	Rosemead
	Saddleback Community College	Mission Viejo
	Saint Mary's College of California	Moraga

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Saint Patrick's College	Mountain View
	San Diego Community College-Central Office	San Diego
	San Diego Community College-City College	San Diego
	San Diego Community College-Evening College	
	San Francisco Art Institute	San Francisco
	San Francisco Conservatory of Music	San Francisco
	San Francisco Theological Seminary	San Anselmo
	San Joaquin Delta College	Stockton
	San Jose Community College District-Evergreen Valley College	San Jose
	San Jose City College	San Jose
	San Mateo County Community College District-System Office	San Mateo
	Canada College	Redwood City
	College of San Mateo	San Mateo
	Skyline College	San Bruno
	Santa Ana College	Santa Ana
	Santa Barbara City College	Santa Barbara
	Santa Monica College	Santa Monica
	Santa Rosa Junior College	Santa Rosa
	Shasta College	Redding
	Sierra College	Rocklin
	Simpson College	San Francisco
	Solano Community College	Suisun City
	Southern California College	Costa Mesa
	Southern California College of Optometry	Fullerton
	Southwestern University School of Law	Los Angeles
	Stanford University	Stanford
	State Center Community College District	
	Fresno City College	Fresno
	Reedley College	Reedley
	Taft College	Taft
	United States International University	San Diego
	University of California-Berkeley	Berkeley
	University of California-Davis	Davis
	University of California Hastings College of Law	San Francisco
	University of California-Irvine	Irvine
	University of California-Los Angeles	Los Angeles
	University of California-Riverside	Riverside
	University of California-San Francisco	San Francisco
	University of California-Santa Barbara	Santa Barbara
	University of the Pacific	Stockton
	University of Redlands	Redlands
	University of San Diego	San Diego
	University of San Francisco	San Francisco
	University of Santa Clara	Santa Clara
	University of Southern California	Los Angeles
	University of West Los Angeles	Culver City
	Ventura County Community College District	
	Moorpark College	Moorpark
	Oxnard College	Oxnard
	Ventura College	Ventura
	West Coast Bible College	Fresno
	West Coast University Central Office	Los Angeles
	West Coast University Orange County Center	Orange
	Western State University College of Law-Orange County	Fullerton
	Western State University College of Law-San Diego	San Diego
	West Hills College	Coalinga
	Westmont College	Santa Barbara
	West Valley College	Saratoga

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Whittier College	Whittier
	Woodbury University	Los Angeles
	The Wright Institute	Berkeley
	Yuba College	Marysville
CO	Adams State College	Alamosa
	Aims Community College	Greeley
	Arapahoe Community College	Littleton
	Colorado College	Colorado Springs
	Colorado Mountain College-East Campus	Leadville
	Colorado Mountain College-West Campus	Glenwood Springs
	Colorado School of Mines	Golden
	Colorado State University	Fort Collins
	Colorado Technical College	Manitou Springs
	Colorado Women's College	Denver
	Community College of Denver-Auraria Campus	Denver
	Community College of Denver-North Campus	Denver
	Community College of Denver-Red Rocks Campus	Golden
	Conservative Baptist Theological Seminary	Denver
	El Paso Community College	Colorado Springs
	Fort Lewis College	Durango
	Iliff School of Theology	Denver
	Lamar Community College	Lamar
	Loretto Heights College	Denver
	Mesa College	Grand Junction
	Metropolitan State College	Denver
	Morgan Community College	Fort Morgan
	Northeastern Junior College	Sterling
	Ortero Junior College	La Junta
	Regis College	Denver
	Rockmont College	Denver
	Saint Thomas Seminary	Denver
	Trinidad State Junior College	Trinidad
	University of Colorado-Boulder	Boulder
	University of Colorado-Colorado Springs	Colorado Springs
	University of Colorado-Denver	Denver
	University of Denver	Denver
	University of Denver College of Law	Denver
	University of Northern Colorado	Greeley
	University of Southern Colorado	Pueblo
	Western Bible College	Morrison
	Western State College of Colorado	Gunnison
CT	Albertus Magnus College	New Haven
	Annhurst College	Woodstock
	Bridgeport Engineering Institute	Bridgeport
	Connecticut College	New London
	Eastern Connecticut State College	Willimnatic
	Greater Hartford Community College	Hartford
	Hartford State Technical College	Hartford
	Housatonic Regional Community College	Bridgeport
	Mattuck Community College	Waterbury
	Middlesex Community College	Middletown
	Mitchell College	New London
	Mohegan Community College	Norwich
	Northwestern Connecticut Community College	Winsted
	Norwalk Community College	Norwald
	Post Junior College	Waterbury
	Quinebaug Valley Community College	Danielson
	Saint Joseph College	West Hartford

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Thames Valley State Technical College	Norwich
	Trinity College	Hartford
	Tunxis Community College	Farmington
	University of Bridgeport	Bridgeport
	University of Hartford	West Hartford
	University of New Haven	West Haven
	Yale University	New Haven
DE	Delaware State College	Dover
	Delaware Technical and Community College	Dover
	Goldey Beacom College	Wilmington
	University of Delaware	Newark
	Wesley College	Dover
DC	American University	Washington
	Catholic University of America	Washington
	District of Columbia Teachers College	Washington
	Gallaudet College	Washington
	George Washington University	Washington
	Howard University	Washington
	Mount Vernon College	Washington
	Trinity College	Washington
FL	Barry College	Miami
	Brevard Community College	Cocoa
	Broward Community College	Fort Lauderdale
	Central Florida Community College	Ocala
	Chipola Junior College	Marianna
	College of Boca Raton	Boca Raton
	Daytona Beach Community College	Daytona Beach
	Eckerd College	St. Petersburg
	Edison Community College	Fort Meyers
	Embry-Riddle Aeronautical University	Daytona Beach
	Flagler College	St. Augustine
	Florida A & M University	Tallahassee
	Florida Atlantic University	Boca Raton
	Florida College	Temple Terrace
	Florida International University	Miami
	Florida Junior College	Jacksonville
	Florida Keys Community College	Key West
	Florida Southern College	Lakeland
	Florida Technological University	Orlando
	Fort Lauderdale College	Fort Lauderdale
	Gulf Coast Community College	Panama City
	Heed University	Hollywood
	Hillsborough Community College	Tampa
	Indian River Community College	Fort Pierce
	Jacksonville University	Jacksonville
	Jones College	Jacksonville
	Lake City Community College	Lake City
	Lake-Sumter Community College	Leesburg
	Manatee Junior College	Bradenton
	Miami Christian College	Miami
	Miami-Dade Community College	Miami
	North Florida Junior College	Madison
	Nova University	Fort Lauderdale
	Okaloosa-Walton Junior College	Niceville
	Palm Beach Atlantic College	West Palm Beach
	Palm Beach Junior College	Lake Worth
	Pensacola Junior College	Pensacola
	Polk Community College	Winter Haven

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Rollins College	Winter Park
	Saint Johns River Junior College	Palatka
	Saint Leo College	Saint Leo
	Santa Fe Community College	Gainesville
	Seminole Community College	Sanford
	South-Eastern Bible College	Lakeland
	South Florida Junior College	Avon Park
	University of Florida	Gainesville
	University of Miami	Coral Gables
	University of North Florida	Jacksonville
	Warner Southern College	Lake Wales
	Webber College	Babson Park
GA	Abraham Baldwin Agricultural College	Tifton
	Agnes Scott College	Decatur
	Albany Area Vocational Technical School	Albany
	Albany Junior College	Albany
	Albany State College	Albany
	Andrew College	Cuthbert
	Armstrong State College	Savannah
	Atlanta Christian College	East Point
	Atlanta Junior College	Atlanta
	Atlanta University	Atlanta
	Augusta College	Augusta
	Bainbridge Junior College	Bainbridge
	Berry College	Mount Berry
	Brenau College	Gainesville
	Brewton-Parker College	Mount Vernon
	Carroll County Area Vocational-Technical School	Carrollton
	Carver Bible Institute and College	Atlanta
	Clark College	Atlanta
	Clayton Junior College	Morrow
	Columbus College	Columbus
	Dalton Junior College	Dalton
	DeKalb Community College	Clarkston
	Emanuel County Junior College	Swainsboro
	Emory University	Atlanta
	Fort Valley State College	Fort Valley
	Gainesville Junior College	Gainesville
	Georgia College	Milledgeville
	Georgia Institute of Technology	Atlanta
	Georgia Military College	Milledgeville
	Georgia Southern College	Statesboro
	Georgia Southwestern College	Americus
	Georgia State University	Atlanta
	Gordon Junior College	Barnesville
	Kennesaw Junior College	Marietta
	LaGrange College	LaGrange
	Macon Junior College	Macon
	Marietta-Cobb Area Vocational Technical School	Marietta
	Mercer University	Macon
	Mercer University in Atlanta	Atlanta
	Middle Georgia College	Cochran
	Morehouse College	Atlanta
	Moultrie Area Vocational-Technical School	Moultrie
	North Georgia College	Dahlonega
	North Georgia Technical and Vocational School	Clarkesville
	Oglethorpe College	Atlanta
	Pickens Area Vocational-Technical School	Jasper
	Piedmont College	Demorest
	Reinhardt College	Waleska

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Savannah Area Vocational Technical School	Savannah
	Savannah State College	Savannah
	Shorter College	Rome
	South Georgia College	Douglas
	South Georgia Technical and Vocational School	Americus
	Southern Technical Institute	Marietta
	Swainsboro Area Vocational-Technical School	Swainsboro
	Thomas Area Vocational-Technical School	Thomasville
	Tift College	Forsyth
	Toccoa Falls College	Toccoa Falls
	Troup County Area Vocational Technical School	LaGrange
	Truett McConnell College	Cleveland
	University of Georgia	Athens
	Upson County Area Vocational-Technical School	Thomaston
	Valdosta State College	Valdosta
	Valdosta Technical School	Valdosta
	Walker County Area Technical School	Rock Spring
	Waycross-Ware Area Technical School	Waycross
	Wesleyan College	Macon
	West Georgia College	Carrollton
	Young Harris College	Young Harris
HI	Brigham Young University-Hawaii Campus	Laie Oahu
	Chaminade College of Honolulu	Honolulu
	Hawaii Pacific College	Honolulu
	University of Hawaii-Honolulu Community College	Honolulu
	University of Hawaii-Kapiolani Community College	Honolulu
	University of Hawaii-Kauai Community College	Lihue
	University of Hawaii-Leeward Community College	Pearl City
	University of Hawaii-Manoa	Honolulu
	University of Hawaii-Maui Community College	Kahului
	University of Hawaii-Windward Community College	Kaneohe
ID	Boise State University	Boise
	College of Southern Idaho	Twin Falls
	Idaho State University	Pocatello
	North Idaho College	Coeur D'Alene
	Northwest Nazarene College	Nampa
	Ricks College	Rexburg
	University of Idaho	Moscow
IL	Augustana College	Rock Island
	Aurora College	Aurora
	Barat College	Lake Forest
	Belleville Area College	Belleville
	Blackburn College	Carlinville
	Black Hawk College	Moline
	Bradley University	Peoria
	Carl Sandburg College	Galesburg
	Central YMCA Community College	Chicago
	Chicago College of Osteopathic Medicine	Chicago
	Chicago State University	Chicago
	College of DuPage	Glen Ellyn

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	College of Lake County	Grayslake
	College of St. Francis	Joliet
	College of the University of Chicago	Chicago
	Danville Junior College	Danville
	DeLourdes College	Des Plaines
	DePaul University	Chicago
	DeVry Institute of Technology	Chicago
	Eastern Illinois University	Charleston
	Elgin Community College	Elgin
	Elmhurst College	Elmhurst
	Eureka College	Eureka
	George Williams College	Downers Grove
	Governors State University	Park Forest South
	Greenville College	Greenville
	Highland Community College	Freeport
	Illinois Benedictine College	Lisle
	Illinois Central College	East Peoria
	Illinois College	Jacksonville
	Illinois College of Optometry	Chicago
	Illinois College of Podiatric Medicine	Chicago
	Illinois Institute of Technology	Chicago
	Illinois State University	Normal
	Illinois Valley Community College	Oglesby
	Illinois Wesleyan University	Bloomington
	Joliet Junior College	Joliet
	Judson College	Elgin
	Kankakee Community College	Kankakee
	Kendall College	Evanston
	Kishwaukee College	Malta
	Knox College	Galesburg
	Lake Forest College	Evanston
	Lakeland College	Mattoon
	Lewis and Clark Community College	Godfrey
	Lincoln Trail College	Robinson
	Logan (John A.) College	Carterville
	Loyola University of Chicago	Chicago
	MacMurray College	Jacksonville
	McHenry County College	Crystal Lake
	McKendree College	Lebanon
	Meadville Theological School	Lombard
	Millikin University	Decatur
	Moraine Valley Community College	Palos Hills
	National College of Chiropractic	Lombard
	North Central College	Naperville
	Northeastern Illinois University	Chicago
	Northern Baptist Theological Seminary	Lombard
	Northern Illinois University	DeKalb
	Northwestern University	Evanston
	Oakton Community College	Morton Grove
	Olivet Nazarene College	Kankakee
	Olney Central College	Mt. Carmel
	Prairie State Community College	Chicago Heights
	Rockford College	Rockford
	Rock Valley College	Rockford
	Roosevelt University	Chicago
	Rush University, College of Nursing and Allied Health Sciences	Chicago
	Rush University, Rush Medical College	Chicago
	Sangamon State University	Springfield
	Sauk Valley College	Dixon
	Southern Illinois University	Carbondale
	Southern Illinois University	Edwardsville
	Spertus College of Judaica	Chicago
	Spoon River College	Canton
	Springfield College in Illinois	Springfield

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	State Community College of East Saint Louis, Illinois	East St. Louis
	Thornton Community College	South Holland
	Triton College	River Grove
	University of Health Sciences, The Chicago Medical School	Chicago
	University of Illinois at Chicago Circle	Chicago
	University of Illinois at the Medical Center, School of Public Health	Chicago
	University of Illinois at Urbana-Champaign	Urbana-Champaign
	Wabash Valley College	Mt. Carmel
	Waubonsee Community College	Sugar Grove
	Western Illinois University	Macomb
	Wheaton College	Wheaton
	William Rainey Harper College	Palatine
IN	Anderson College	Anderson
	Associated Mennonite Biblical Seminary	Elkhart
	Ball State University	Muncie
	Bethel College	Mishawaka
	Butler University	Indianapolis
	DePauw University	Greencastle
	Earlham College	Richmond
	Franklin College	Franklin
	Goshen College	Goshen
	Grace College	Winona Lake
	Hanover College	Hanover
	Holy Cross Junior College	Notre Dame
	Huntington College	Huntington
	Indiana Central College	Indianapolis
	Indiana Institute of Technology	Fort Wayne
	Indiana State University	Evansville
	Indiana University	Bloomington
	Indiana University-East	Richmond
	Indiana University-Kokomo	Kokomo
	Indiana University-Northwest	Gary
	Indiana University-South Bend	South Bend
	Indiana University-Southeast	New Albany
	Indiana University-Purdue University at Fort Wayne	Fort Wayne
	Indiana Vocational Technical College	Indianapolis
	International Junior College	Fort Wayne
	Manchester College	North Manchester
	Marian College	Indianapolis
	Marion College	Marion
	Oakland College	Oakland City
	Purdue State University	Muncie
	Purdue University	West Lafayette
	Purdue University-Calumet	Calumet
	Purdue University-North Central	Westville
	Rose-Hulman Institute of Technology	Terre Haute
	Saint Joseph's College	Rensselaer
	Saint Mary's College	Notre Dame
	Saint Mary of the Woods College	Saint Mary of the Woods
	Saint Meinard College	St. Meinard
	Taylor University	Upland
	Tri-State University	Angola
	University of Evansville	Evansville
	University of Notre Dame	South Bend
	Valparaiso University	Valparaiso
	Vincennes University	Vincennes
	Wabash College	Crawfordsville

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
IA	Area One Vocational-Technical School	Calmar and Dubuque
	Briar Cliff College	Sioux City
	Central College	Pella
	Clarke College	Dubuque
	Coe College	Cedar Rapids
	Cornell College	Mt. Vernon
	Des Moines Area Community College	Ankeny
	Drake University	Des Moines
	Ellsworth Community College	Iowa Falls
	Grinnell College	Grinnell
	Hawkeye Institute of Technology	Waterloo
	Iowa Central Community College	Fort Dodge
	Iowa Lakes Community College	Estherville
	Iowa State University	Ames
	Iowa Wesleyan College	Mount Pleasant
	Iowa Western Community College	Council Bluffs
	Kirkwood Community College	Cedar Rapids
	Loras College	Dubuque
	Luther College	Decorah
	Marshalltown Community College	Marshalltown
	Marycrest College	Davenport
	Morningside College	Sioux City
	Mount Mercy College	Cedar Rapids
	North Iowa Area Community College	Mason City
	Open Bible College	Des Moines
	Palmer College of Chiropractic	Davenport
	Simpson College	Indianola
	Southeastern Community College	Burlington
	Southwestern Community College	Creston
	University of Dubuque	Dubuque
	University of Dubuque Theological Seminary	Dubuque
	University of Iowa	Iowa City
	University of Northern Iowa	Cedar Falls
	Upper Iowa University	Fayette
	Wartburg College	Waverly
	Wartburg Seminary	Dubuque
	Westmar College	LeMars
	Western Iowa Technical Community College	Sioux City
KS	Allen County Community Junior College	Iola
	Baker University	Baldwin
	Barton County Community College	Great Bend
	Benedictine College	Atchison
	Bethel College	North Newton
	Central College	McPherson
	Cloud County Community College	Concordia
	Coffeyville Community Junior College	Coffeyville
	Colby Community College	Colby
	Cowley County Community College	Arkansas City
	Dodge City Community College	Dodge City
	Donnelly College	Kansas City
	Emporia Kansas State College	Emporia
	Fort Hays Kansas State College	Hays
	Fort Scott Community College	Fort Scott
	Friends Bible College	Haviland
	Garden City Community College	Garden City
	Haskell Indian Junior College	Lawrence
	Hesston College	Hesston
	Highland Community Junior College	Highland
	Hutchinson Community Junior College	Hutchinson
	Independence Community Junior College	Independence
	Johnson County Community College	Overland Park
	Kansas City Community College	Kansas City

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Kansas Newman College	Wichita
	Kansas State College of Pittsburg	Pittsburg
	Kansas State University	Manhattan
	Kansas Technical Institute	Salina
	Kansas Wesleyan	Salina
	Labette Community Junior College	Parsons
	Manhattan Christian College	Manhattan
	Marymount College of Kansas	Salina
	McPherson College	McPherson
	Mid-America Nazarene College	Olathe
	Neosho County Community Junior College	Chanute
	Ottawa University	Ottawa
	Pratt Community College	Pratt
	Saint John's College	Winfield
	Saint Mary College	Leavenworth
	Saint Mary of the Plains College	Dodge City
	Seward County Community College	Liberal
	Southwestern College in Kansas	Winfield
	Sterling College	Sterling
	Tabor College	Hillsboro
	The University of Kansas	Lawrence
	Washburn University of Topeka	Topeka
	Wichita State University	Wichita
KY	Alice Lloyd College	Pippa Passes
	Asbury College	Wilmore
	Bellarmine College	Louisville
	Berea College	Berea
	Brescia College	Owensboro
	Campbellsville College	Campbellsville
	Centre College of Kentucky	Danville
	Cumberland College	Williamsburg
	Eastern Kentucky University	Richmond
	Georgetown College	Georgetown
	Jefferson Vocational Regional Office	Jeffersontown
	Kentucky Christian College	Grayson
	Kentucky State University	Frankfort
	Kentucky Wesleyan College	Owensboro
	Lees Junior College	Jackson
	Lindsey Wilson College	Columbia
	Midway College	Midway
	Morehead State University	Morehead
	Murray State University	Murray
	Pikeville College	Pikeville
	Saint Catharine College	Saint Catharine
	Southeastern Christian College	Winchester
	Sue Bennett College	London
	Thomas More College	Fort Mitchell
	Transylvania University	Lexington
	University of Kentucky	Lexington
	University of Kentucky Community College System	Lexington
	University of Louisville	Louisville
	Western Kentucky University	Bowling Green
LA	Bossier Parish Community College	Bossier City
	Centenary College of Louisiana	Shreveport
	Delgado College	New Orleans
	Dillard University	New Orleans
	Grambling State University	Grambling
	Louisiana State University-Central Office	Baton Rouge

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Louisiana State University and Agricultural and Mechanical College at Baton Rouge	Baton Rouge
	Louisiana State University-Alexandria	Alexandria
	Louisiana State University-Eunice	Eunice
	Louisiana State University-Shreveport	Shreveport
	University of New Orleans	New Orleans
	Louisiana Tech University	Ruston
	McNeese State University	Lake Charles
	New Orleans Baptist Theological Seminary	New Orleans
	Northeast Louisiana University	Monroe
	Northwestern State University of Louisiana	Natchitoches
	Notre Dame Seminary School of Theology	New Orleans
	Our Lady of Holy Cross College	New Orleans
	Saint Bernard Parish Community College	Chalmette
	Saint Joseph Seminary College	Saint Benedict
	Saint Mary's Dominican College	New Orleans
	Southern University in New Orleans	New Orleans
	Tulane University of Louisiana	New Orleans
	Xavier University of Louisiana	New Orleans
ME	Bowdoin College	Brunswick
	Colby College	Waterville
	College of the Atlantic	Bar Harbor
	Eastern Maine Vocational and Technical Institute	Bangor
	Maine Maritime Academy	Castine
	Masson College	Springvale
	South Maine Vocational and Technical Institute	South Portland
	Unity College	Unity
	University of Maine at Orono	Orono
MD	Bowie State College	Bowie
	Catonsville Community College	Catonsville
	Charles County Community College	La Plata
	Chesapeake College	Wye Mills
	Columbia Union College	Takoma Park
	Community College of Baltimore	Baltimore
	Dundalk Community College	Baltimore
	Essex Community College	Baltimore County
	Garrett Community College	McHenry
	Goucher College	Towson
	Hagerstown Junior College	Hagerstown
	Harford Community College	Bel Air
	Hood College	Frederick
	Howard Community College	Columbia
	Johns Hopkins University	Baltimore
	Loyola College	Baltimore
	Montgomery College	Rockville
	Saint John's College	Annapolis
	Saint Mary's College of Maryland	Saint Mary's City
	Towson State College	Baltimore
	University of Baltimore	Baltimore
	University of Maryland	College Park
	Villa Julie College	Stevenson
	Washington College	Chestertown

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
MA	Amherst College	Amherst
	Anna Maria College	Paxton
	Assumption College	Worcester
	Bay Path Junior College	Longmeadow
	Bentley College	Waltham
	Boston College	Chestnut Hill
	Boston University	Boston
	Gordon College	Wenham
	Hampshire College	Amherst
	Harvard University	Cambridge
	Lasell Junior College	Auburndale
	Lesley College	Cambridge
	Massachusetts Institute of Technology	Cambridge
	Merrimack College	North Andover
	Mount Holyoke College	South Hadley
	Nichols College	Dudley
	Northeastern University	Boston
	Regis College	Weston
	Simon's Rock	Great Barrington
	Smith College	Northampton
	Southeastern Massachusetts University	North Darmouth
	Springfield College	Springfield
	Springfield Technical Community College	Springfield
	Stonehill College	North Easton
	Suffolk University	Boston
	Tufts University	Medford
	University of Massachusetts	Boston
	Wentworth Institute	Boston
	Wheelock College	Boston
	Williams College	Williamstown
	Worcester Junior College	Worcester
	Worcester Polytechnic Institute	Worcester
MI	Alma College	Alma
	Alpena Community College	Alpena
	Andrews University	Berrien Springs
	Aquinas College	Grand Rapids
	Bay de Noc Community College	Escanaba
	Calvin College	Grand Rapids
	Calvin Theological Seminary	Grand Rapids
	Central Michigan University	Mount Pleasant
	Concordia Lutheran Junior College	Ann Arbor
	Delta College	University Center
	Detroit Institute of Technology	Detroit
	Eastern Michigan University	Ypsilanti
	Ferris State College	Big Rapids
	General Motors Institute	Flint
	Grace Bible College	Wyoming
	Grand Rapids Baptist College	Grand Rapids
	Grand Rapids Junior College	Grand Rapids
	Grand Valley State College	Allendale
	Highland Park Community College	Highland Park
	Hillsdale College	Hillsdale
	Hope College	Holland

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Jackson Community College	Jackson
	Kalamazoo College	Kalamazoo
	Kalamazoo Valley Community College	Kalamazoo
	Kirtland Community College	Roscommon
	Lake Michigan College	Benton Harbor
	Lake Superior State College	Saulte Ste. Marie
	Lansing Community College	Lansing
	Macomb County Community College	Warren
	Madonna College	Livonia
	Marygrove College	Detroit
	Mercy College of Detroit	Detroit
	Merrill-Palmer Institute	Detroit
	Michigan Department of Education-Environmental Guidelines	Lansing
	Michigan State University	East Lansing
	Michigan Technological University	Houghton
	Mid Michigan Community College	Harrison
	Monroe County Community College	Monroe
	Montcalm Community College	Sidney
	Mott Community College	Flint
	Muskegon Business College	Muskegon
	Muskegon Community College	Muskegon
	Northern Michigan University	Marquette
	Northwestern Michigan College	Traverse City
	Oakland Community College	Bloomfield Hills
	Oakland University	Rochester
	Olivet College	Olivet
	Saginaw Valley State College	University Center
	Saint Mary's College	Orchard Lake
	Schoolcraft College	Livonia
	Shaw College at Detroit	Detroit
	Southwestern Michigan College	Dowagiac
	Spring Arbor College	Spring Arbor
	Suomi College	Hancock
	University of Detroit	Detroit
	University of Michigan	Ann Arbor
	Walsh College	Troy
	Washtenaw Community College	Ann Arbor
	Wayne County Community College	Detroit
	Wayne State University	Detroit
	Western Michigan University	Kalamazoo
	West Shore Community College	Scottville
	Western Theological Seminary	Holland
MN	Anoka-Ramsey Community College	Coon Rapids
	Augsburg College	Minneapolis
	Austin Community College	Austin
	Bemidji State University	Bemidji
	Bethany Lutheran College	Mankato
	Brainerd Community College	Brainerd
	Carleton College	Northfield
	College of Saint Benedict	St. Joseph
	College of St. Catherine	St. Paul
	College of St. Scholastica	Duluth
	College of St. Thomas	St. Paul
	Concordia College	Moorhead
	Crosier Seminary Junior College	Onamia
	Dr. Martin Luther College	New Ulm
	Fergus Falls Community College	Fergus Falls
	Hibbing Community College	Hibbing
	Itasca Community College	Grand Rapids
	Lakewood Community College	White Bear Lake
	Luther Theological Seminary	St. Paul
	Macalester College	St. Paul
	Mankato State University	Mankato

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Mesabi Community College	Virginia
	Metropolitan Community College	Minneapolis
	Metropolitan State University	St. Paul
	Minneapolis College of Art and Design	Minneapolis
	Minnesota Bible College	Rochester
	Moorhead State College	Moorhead
	Normandale Community College	Bloomington
	North Hennepin Community College	Minneapolis
	Northland Community College	Thief River Falls
	Northwestern College	Roseville
	Rainy River Community College	International Falls
	Rochester Community College	Rochester
	Saint John's University	Collegeville
	Saint Mary's College	Winona
	Southwest Minnesota State College	Marshall
	St. Cloud Area Vocational Technical Institute	St. Cloud
	St. Cloud State University	St. Cloud
	St. Mary's Junior College	Minneapolis
	St. Paul Bible College	Bible College
	United Theological Seminary of the Twin Cities	New Brighton
	University of Minnesota	Minneapolis
	Vermilion Community College	Ely
	William Mitchell College of Law	St. Paul
	Winona State University	Winona
	Worthington Community College	Worthington
MS	Alcorn State University	Lorman
	Belhaven College	Jackson
	Clarke College	Newton
	Coahama Junior College	Clarksdale
	Copiah-Lincoln Junior College	Wesson
	Delta State University	Cleveland
	East Central Junior College	Decatur
	East Mississippi Junior College	Scooba
	Hinds Junior College	Raymond
	Holmes Junior College	Goodman
	Itawamba Junior College	Fulton
	Jackson State University	Jackson
	John C. Stennis Vocational Complex	Dekalb
	Jones County Junior College	Ellisville
	Mary Holmes College	West Point
	Meridian Junior College	Meridian
	Millsaps College	Jackson
	Mississippi College	Clinton
	Mississippi Delta Junior College	Moorhead
	Mississippi Gulf Coast Junior College	Perkinston
	Mississippi Industrial College	Holly Springs
	Mississippi State University	Mississippi State
	Mississippi University for Women	Columbus
	Northeast Mississippi Junior College	Booneville
	Northwest Mississippi Junior College	Senatobia
	Pearl River Junior College	Poplarville
	Rust College	Holly Springs
	Southwest Mississippi Junior College	Summit
	Tougaloo College	Tougaloo
	University of Mississippi	University
	University of Mississippi Medical Center	Jackson
	University of Southern Mississippi	Hattiesburg
	Utica Junior College	Utica
	Wesley College	Florence
	William Carey College	Hattiesburg
	Wood Junior College	Mathiston

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
MO	Assemblies of God Graduate School	Springfield
	Avila College	Kansas City
	Calvary Bible College	Kansas City
	Central Bible College	Springfield
	Central Methodist College	Fayette
	Central Missouri State University	Warrensburg
	Columbia College	Columbia
	Concordia Seminary	St. Louis
	Cottey College	Nevada
	Crowder College	Neosho
	Culver-Stockton College	Canton
	Fontbonne College	St. Louis
	Hannibal Lagrange College	Hannibal
	Harris Teachers College	St. Louis
	Jefferson College	Hillsboro
	Kansas City Art Institute	Kansas City
	Kansas City College of Osteopathic Medicine	Kansas City
	Logan College of Chiropractic	Chesterfield
	Longview Community College	Kansas City
	Maple Woods Community College	Kansas City
	Maryville College	St. Louis
	Meramec Community College	St. Louis
	Missouri Baptist College	St. Louis
	Missouri Southern State College	Joplin
	Moberly Area Junior College	Moberly
	Northeast Missouri State University	Kirksville
	Northwest Missouri State University	Maryville
	Rockhurst College	Kansas City
	Saint Louis College of Pharmacy	St. Louis
	Saint Louis Community College at Forest Park	St. Louis
	Saint Louis University	St. Louis
	Saint Paul's College	Concordia
	School of the Ozarks	Point Lookout
	Southwest Missouri State University	Springfield
	State Fair Community College	Sedalia
	Stephen's College	Columbia
	Tarkio College	Tarkio
	The Principia	St. Louis
	Three Rivers Community College	Poplar Bluff
	University of Missouri-Columbia	Columbia
	University of Missouri-Kansas City	Kansas City
	University of Missouri-Rolla	Rolla
	University of Missouri-St. Louis	St. Louis
	Washington University	St. Louis
	Water and Wastewater Technical School	Neosho
	Webster College	Webster
	Westminster College	Fulton
	William Jewell College	Kansas City
MT	Carroll College	Helena
	College of Great Falls	Great Falls
	Dawson College	Glendive
	Eastern Montana College	Billings
	Flathead Valley Community College	Kalispell
	Miles Community College	Miles City
	Montana College of Mineral Science and Technology	Butte
	Montana State University	Bozeman
	Northern Montana College	Havre
	Rocky Mountain College	Billings
	University of Montana	Missoula
	Western Montana College	Dillon

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
NE	Central Technical Community College	Hastings
	Chadron State College	Chadron
	College of Saint Mary	Omaha
	Concordia College	Seward
	Creighton University	Omaha
	Dana College	Blair
	Doane College	Crete
	Grace College of the Bible	Omaha
	Hastings College	Hastings
	Kearney State College	Kearney
	McCook Community College	McCook
	Midland Lutheran College	Fremont
	Mid-Plains Community College	North Platte
	Northeast Technical Community College	Norfolk
	Platte Technical Community College	Columbus
	Southeast Community College	Lincoln
	Union College	Lincoln
	University of Mid-America	Lincoln
	University of Nebraska	Lincoln
	Wayne State College	Wayne
NV	University of Nevada-Las Vegas	Las Vegas
	University of Nevada-Reno	Reno
	Clark County Community College	Las Vegas
	Northern Nevada Community College	Elko
	Sierra Nevada College	Incline Village
	Western Nevada Community College	Carson City
NH	Colby-Sawyer College	New London
	Dartmouth College	Hanover
	Franklin Pierce College	Rindge
	New England College	Henniker
	NH Technical Institute	Concord
	NH Voc-Tech College of Berlin	Berlin
	NH Voc-Tech College of Claremont	Claremont
	NH Voc-Tech College of Laconia	Laconia
	NH Voc-Tech College of Manchester	Manchester
	NH Voc-Tech College of Nashua	Nashua
	NH Voc-Tech College of Portsmouth	Portsmouth
	Saint Anselm's College	Manchester
	University of New Hampshire	Durham
	White Pines College	Chester
NJ	Atlantic Community College	Mays Landing
	Bergen Community College	Paramus
	Brookdale Community College	Lincroft
	Burlington County College	Penberton
	Camden County College	Caldwell
	Centenary College for Women	Hackettstown
	County College of Morris	Dover
	Cumberland County College	Vineland
	Drew University	Madison
	Fairleigh Dickinson University	Rutherford
	Gloucester County College	Sewell
	Kean College of New Jersey	Union
	Mercer County Community College	Trenton
	Middlesex County College	Edison
	Montclair State College	Upper Montclair
	New Jersey Institute of Technology	Newark
	Ocean County College	Toms River
	Passaic County Community College	Paterson
	Princeton University	Princeton

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Rider College	Trenton
	Rutgers the State University	New Brunswick
	Stevens Institute of Technology	Hoboken
	Trenton State College	Trenton
	Union College	Cranford
	Union County Technical Institute	Scotch Plains
	William Paterson College	Wayne
NM	College of the Southwest	Hobbs
	Eastern New Mexico University-Main Campus	Portales
	Eastern New Mexico University-Roswell	Roswell
	New Mexico Highlands University	Las Vegas
	New Mexico Institute of Mining and Technology	Socorro
	New Mexico Junior College	Hobbs
	New Mexico Military Institute	Roswell
	New Mexico State University-Las Cruces	Las Cruces
	New Mexico State University-San Juan	San Juan
	University of Albuquerque	Albuquerque
	University of New Mexico-Main Campus	Albuquerque
NY	Adelphi University	Garden City
	Albany College Pharmacy	Albany
	Albany Law School	Albany
	Alfred University	Alfred
	Bard College	Annandale-on-Hudson
	Bronx Community College	Bronx
	Brooklyn Law School	Brooklyn
	Canisius	Buffalo
	City University of New York	New York
	Clarkson College of Technology	Potsdam
	Colgate University	Hamilton
	College of Mt. Saint Vincent	Riverdale
	College of Saint Rose	Albany
	Columbia University	New York
	Concordia College	Bronxfille
	Cornell University	Ithaca
	Dowling College	Oakdale Long Island
	D'Youville College	Buffalo
	Erie Community College	Buffalo
	Hamilton College	Clinton
	Hartwick College	Oneonta
	Hilbert College	Hamburg
	Hobart-William Smith Colleges	Geneva
	Hofstra University	Hempstead
	Houghton College	Houghton
	Hudson Valley Community College	Troy
	Hunter College	New York
	Ithaca College	Ithaca
	King's College	Briarcliff Manor
	Long Island University	Greenvale
	Manhattan College	Bronx
	Medaille College	Buffalo
	Mercy College	Dobbs Ferry
	Molloy College	Rockville Centre
	New School for Social Research	New York
	New York Institute of Technology	Old Westbury
	New York Law School	New York
	Niagara University	Niagara University

APPENDIX V
CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Paul Smith's College of Arts & Science	Paul Smiths
	Polytechnic Institute of New York	Brooklyn
	Rensselaer Polytechnic Institute	Troy
	Roberts Wesleyan College	Rochester
	Rochester Institute of Technology	Rochester
	Rockefeller University	New York
	Saint Banaventure University	Saint Bonaventure
	Saint John Fisher College	Rochester
	Saint John's University	Jamaica
	Saint Lawrence University	Canton
	Saint Thomas Aquinas College	Sparkhill
	Skidmore College	Saratoga Springs
	Southampton College	Southampton
	State University of New York at Buffalo	Buffalo
	Syracuse University	Syracuse
	The Cooper Union	New York
	Trocaire College	Buffalo
	Ulster County Community College	Stone Ridge
	University of Rochester	Rochester
	Vassar College	Poughkeepsie
	Wagner College	Staten Island
	Webb Institute of Naval Architecture	Glen Cove
	Westchester Community College	Valhalla
NC	Anson Technical Institute	Ansonville
	Appalachian State University	Boone
	Asheville Buncombe Technical Institute	Asheville
	Atlantic Christian College	Wilson
	Beaufort County Technical Institute	Washington
	Belmont Abbey College	Belmont
	Bennett College	Greensboro
	Bladen Technical Institute	Dublin
	Blue Ridge Technical Institute	Flat Rock
	Brevard College	Brevard
	Campbell College	Buies Creek
	Cape Fear Technical Institute	Wilmington
	Carteret Technical Institute	Morehead City
	Catawba College	Salisbury
	Catawba Valley Technical Institute	Hickory
	Central Carolina Technical Institute	Sanford
	Central Piedmont Community College	Charlotte
	Chowan College	Murfreesboro
	Cleveland County Technical Institute	Shelby
	Coastal Carolina Community College	Jacksonville
	College of the Albemarle	Elizabeth City
	Craven Community College	New Bern
	Davidson College	Davidson
	Davidson County Community College	Lexington
	Duke University	Durham
	Durham College	Durham
	East Carolina University	Greenville
	Elon College	Elon College
	Fayetteville State University	Fayetteville
	Fayetteville Technical Institute	Fayetteville
	Gardner Webb College	Boiling Springs
	Gaston College	Dallas
	Greensboro College	Greensboro
	Guilford College	Greensboro
	Guilford Technical Institute	Jamestown
	Halifax Community College	Weldon
	Haywood Technical Institute	Clyde
	High Point College	High Point
	Isothermal Community College	Spindale
	James Sprunt Institute	Kenansville
	Johnson C. Smith University	Charlotte

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Johnston Technical Institute	Smithfield
	Lees-McCrae College	Banner Elk
	Lenoir Community College	Kinston
	Lenoir-Rhyne College	Hickory
	Livingstone College	Salisbury
	Louisburg College	Louisburg
	Mars Hill College	Mars Hill
	Martin Community College	Williamston
	Mayland Technical Institute	Spruce Pine
	McDowell Technical Institute	Marion
	Meredith College	Raleigh
	Methodist College	Fayetteville
	Montreat-Anderson College	Montreat
	Mount Olive College	Mount Olive
	Nash Technical Institute	Rocky Mount
	North Carolina Agricultural and Technical State University	Greensboro
	North Carolina Central University	Durham
	North Carolina State University	Raleigh
	North Carolina Wesleyan College	Rocky Mount
	Pembroke State University	Pembroke
	Pfeiffer College	Misenheimer
	Piedmont Bible College	Winston-Salem
	Piedmont Technical Institute	Roxboro
	Pitt Technical Institute	Greenville
	Queens College	Charlotte
	Randolph Technical Institute	Asheboro
	Richmond Technical Institute	Hamlet
	Roanoke-Chowan Technical Institute	Ahoskie
	Robeson Technical Institute	Lumberton
	Rockingham Community College	Wentworth
	Rowan Technical Institute	Salisbury
	Saint Andrews Presbyterian College	Laurinburg
	Saint Augustine's College	Raleigh
	Saint Mary's College	Raleigh
	Salem College	Winston-Salem
	Sampson Technical Institute	Clinton
	Sandhills Community College	Carthage
	Shaw University	Raleigh
	Stanly Technical Institute	Albermarle
	Surry Community College	Dobson
	Technical Institute of Alamance	Burlington
	Tri-County Technical Institute	Murphy
	University of North Carolina at Chapel Hill	Chapel Hill
	University of North Carolina at Charlotte	Charlotte
	University of North Carolina at Greensboro	Greensboro
	University of North Carolina at Wilmington	Wilmington
	Wake Forest University	Winston-Salem
	Wake Technical Institute	Raleigh
	Warren Wilson College	Swannanoa
	Wayne Community College	Goldsboro
	Western Carolina University	Cullowhee
	Western Piedmont Community College	Morganton
	Wilkes Community College	Wilkesboro
	Wilson County Technical Institute	Wilson
	Wingate College	Wingate
	Winston-Salem State University	Winston-Salem

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
ND	Bismarck Junior College	Bismarck
	Dickinson State College	Dickinson
	Jamestown College	Jamestown
	Lake Region Junior College	Devils Lake
	Mary College	Bismarck
	Mayville State College	Mayville
	Minot State College	Minot
	North Dakota State School of Science	Wahpeton
	North Dakota State University-Main Campus	Fargo
	North Dakota State University-Bottineau	Bottineau
	Trinity Bible Institute	Ellendale
	University of North Dakota-Main Campus	Grand Forks
	University of North Dakota-Williston	Williston
OH	Antioch College	Yellow Springs
	Art Academy of Cincinnati	Cincinnati
	Bluffton College	Bluffton
	Capital University	Columbus
	Case Western Reserve University	Cleveland
	Central Ohio Technical College	Newark
	Central State University	Wilberforce
	Cincinnati Bible College	Cincinnati
	Cincinnati Technical College	Cincinnati
	Clark Technical College	Springfield
	Cleveland Institute of Art	Cleveland
	Cleveland Institute of Music	Cleveland
	Cleveland State University	Cleveland
	College of Mount St. Joseph on the Ohio	Cincinnati
	College of Steubenville	Steubenville
	College of Wooster	Wooster
	Columbus College of Art and Design	Columbus
	Columbus Technical Institute	Columbus
	Cuyahoga Community College	Cleveland
	Davis Junior College	Toledo
	Defiance College	Defiance
	Denison University	Granville
	Franklin University	Columbus
	Hebrew Union College	Cincinnati
	Heidelberg College	Tiffin
	Hiram College	Hiram
	Hocking Technical College	Nelsonville
	Jefferson County Technical Institute	Steubenville
	John Carroll University	Cleveland
	Josephinum College of Liberal Arts	Worthington
	Kent State University	Kent
	Kenyon College	Gambier
	Kettering College of Medical Arts	Kettering
	Lakeland Community College	Mentor
	Lima Technical College	Lima
	Lorain County Community College	Elyria
	Lutheran Theological Seminary	Columbus
	Malone College	Canton
	Marietta College	Marietta
	Marion Technical College	Marion
	Medical College of Ohio	Toledo
	Miami-Jacobs Junior College	Dayton
	Miami University	Oxford
	Mount Union College	Alliance
	Mount Vernon Nazarene College	Mount Vernon
	Muskingum Area Technical College	Zanesville
	Muskingum College	New Concord
	National Training and Operational Technology Center (EPA)	Cincinnati
	North Central Technical College	Mansfield

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Northwest Technical College	Archbold
	Notre Dame College	Cleveland
	Oberlin College	Oberlin
	Ohio Board of Regents-Technical Education Offerings	Columbus
	Ohio Dominican College	Columbus
	Ohio Northern University	Ada
	Ohio State University	Columbus
	Ohio University	Athens
	Ohio Wesleyan University	Delaware
	Owens Technical College	Perrysburg
	Saint John College of Cleveland	Cleveland
	Sinclair Community College	Dayton
	Stark Technical College	Canton
	Tiffin University	Tiffin
	United Theological Seminary	Dayton
	University of Cincinnati	Cincinnati
	University of Dayton	Dayton
	University of Toledo	Toledo
	Urbana College	Urbana
	Washington Technical College	Marietta
	Wittenberg University	Springfield
	Wright State University	Dayton
	Xavier University	Cincinnati
	Youngstown State University	Youngstown
OK	Bacone College	Muskogee
	Bartlesville Weslyan College	Bartlesville
	Bethany Nazarene College	Bethany
	Cameron University	Lawton
	Carl Albert Junior College	Poteau
	Central State University	Edmond
	Claremore Junior College	Claremore
	Connors State College	Warner
	East Central Oklahoma State University	Ada
	Eastern Oklahoma State College	Wilburton
	El Reno Junior College	El Reno
	Hillsdale Free Will Baptist College	Moore
	Midwest Christian College	Oklahoma City
	Murray State College	Tishomingo
	Northeastern Oklahoma Agricultural and Mechanical College	Miami
	Northeastern Oklahoma State University	Tahlequah
	Northern Oklahoma College	Tonkawa
	Northwesterm Oklahoma State University	Alva
	Oklahoma Baptist University	Shawnee
	Oklahoma Christian College	Oklahoma City
	Oklahoma City University	Oklahoma City
	Oklahoma Panhandle State University	Goodwell
	Oklahoma School of Business, Accountancy, Law and Finance	Tulsa
	Oklahoma State University-Main Campus	Stillwater
	Oklahoma State University-Oklahoma City	Oklahoma City
	Oral Roberts University	Tulsa
	Oscar Rose Junior College	Midwest City
	Phillips University	Enid
	Saint Gregory's College	Shawnee
	Sayre Junior College	Sayre
	Seminole Junior College	Seminole
	Southeastern Oklahoma State University	Durant
	South Oklahoma City Junior College	Oklahoma City
	Southwestern College	Oklahoma City
	Tulsa Junior College	Tulsa
	University of Oklahoma-Central Office	Norman

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	University of Oklahoma-Health Science Center	Oklahoma City
	University of Science and Arts of Oklahoma	Chickasha
	University of Tulsa	Tulsa
	Western Oklahoma State College	Altus
OR	Blue Mountain Community College	Pendleton
	Chemeketa Community College	Salem
	Clackamas Community College	Oregon City
	Clatsop Community College	Astoria
	Columbia Christian College	Portland
	Concordia College	Portland
	George Fox College	Newberg
	Judson Baptist College	Portland
	Lane Community College	Eugene
	Lewis and Clark College	Portland
	Linfield College	McMinnville
	Linn-Benton Community College	Albany
	Marylhurst Education Center	Marylhurst
	Mount Hood Community College	Gresham
	Multnomah School of the Bible	Portland
	Museum Art School	Portland
	Oregon State Higher Education District	
	Eastern Oregon State College	La Grande
	Oregon College of Education	Monmouth
	Oregon Institute of Technology	Klamath Falls
	Oregon State University	Corvallis
	Portland State University	Portland
	Southern Oregon State College	Ashland
	University of Oregon-Health Sciences Center	Portland
	Pacific University	Forest Grove
	Reed College	Portland
	Southwestern Oregon Community College	Coos Bay
	Treasure Valley Community College	Ontario
	Umpqua Community College	Rosenburg
	University of Portland	Portland
	Warner Pacific College	Portland
	Western Baptist Bible College	Salem
	Western Conservative Baptist Seminary	Portland
	Western Evangelical Seminary	Portland
	Williamette University	Salem
PA	Allegheny College	Meadville
	Allentown College of St. Francis De Sales	Center Valley
	Alliance College	Cambridge Springs
	Beaver College	Glenside
	Bloomsburg State College	Bloomsburg
	Bucks County Community College	Newton
	Butler County Community College	Butler
	Cabrini College	Radnor
	California State College	California
	Carlow College	Pittsburgh
	Carnegie-Mellon University	Pittsburgh
	Cedar Crest College	Allentown
	Chestnut Hill College	Philadelphia
	Cheyney State College	Cheyney
	Clarion State College	Clarion
	Community College of Allegheny County	Pittsburgh
	Community College of Beaver County	Monaca
	Community College of Philadelphia	Philadelphia
	Delaware Valley College of Science and Agriculture	Doylestown

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Dickinson College	Carlisle
	Drexel University	Philadelphia
	The Dropsie University	Philadelphia
	Duquesne University	Pittsburgh
	Eastern College	Saint Davids
	East Stroudsburg State College	East Stroudsburg
	Edinboro State College	Edinboro
	Franklin-Marshall College	Lancaster
	Gannon College	Erie
	Geneva College	Beaver Falls
	Gettysburg College	Gettysburg
	Gwynedd-Mercy College	Gwynedd Valley
	Harcum Junior College	Bryn Mawr
	Haverford College	Haverford
	Indiana University of Pennsylvania	Indiana
	Juniata College	Huntingdon
	Keystone Junior College	La Plume
	King's College	Wilkes-Barre
	Lafayette College	Easton
	La Roche College	Allison Park
	La Salle College	Philadelphia
	Lehigh University	Bethlehem
	Lincoln University	Lincoln University
	Lock Haven State College	Lock Haven
	Lycoming College	Williamsport
	Mansfield State College	Mansfield
	Marywood College	Scranton
	Mercyhurst College	Erie
	Millersville State College	Millersville
	Montgomery County Community College	Blue Bell
	Northeastern Christian Junior College	Villanova
	Pennsylvania State University	University Park
	Philadelphia College of Pharmacy and Science	Philadelphia
	Point Park College	Pittsburgh
	Reading Area Community College	Reading
	Saint Fidelis College	Herman
	Saint Francis College	Loretto
	Saint Joseph's College	Philadelphia
	Saint Vincent College	Latrobe
	Seton Hill College	Greensburg
	Slippery Rock State College	Slippery Rock
	Spring Garden College	Chestnut Hill
	Susquehanna University	Selinsgrove
	Swarthmore College	Swarthmore
	Temple University	Philadelphia
	University of Pennsylvania	Philadelphia
	University of Pittsburg	Pittsburgh
	University of Scranton	Scranton
	Ursinus College	Collegeville
	Villa Maria College	Erie
	Villanova University	Villanova
	Waynesburg College	Waynesburg
	West Chester State College	West Chester
	Westminster College	New Wilmington
	Widener College	Chester
	Wilkes College	Wilkes-Barre
	Williamsport Area Community College	Williamsport
	Wilson College	Chambersburg
PR	Inter American University of Puerto Rico	San German
	The Catholic University of Puerto Rico	Ponce
	University of Puerto Rico	Mayaguez
	University of Puerto Rico	Rio Pedras

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
RI	Brown University	Providence
	Providence College	Providence
	Roger Williams College	Bristol
	University of Rhode Island	Kingston
SC	Aiken Technical Education Center	Aiken
	Baptist College	Charleston
	Bob Jones University	Greenville
	Central Wesleyan College	Central
	Citadel Military College of South Carolina	Charleston
	Claflin College	Orangeburg
	Clemson University	Clemson
	Coastal Carolina College	Conway
	Coker College	Hartsville
	College of Charleston	Charleston
	Columbia College	Columbia
	Columbia Bible College	Columbia
	Converse College	Spartanburg
	Erskine College	Due West
	Florence-Darlington Technical College	Florence
	Francis Marion College	Florence
	Furman University	Greenville
	Greenville Technical College	Greenville
	Lander College	Greenwood
	Limestone College	Gaffney
	Morris College	Sumter
	Newberry College	Newberry
	North Greenville College	Tigerville
	Orangeburg-Calhoun Technical College	Orangeburg
	Piedmont Technical College	Greenwood
	South Carolina State College	Orangeburg
	Sumter Area Technical College	Sumter
	Tri County Technical College	Pendleton
	Trident Technical College	North Charleston
	University of South Carolina	Columbia
	University of South Carolina at Aiken	Aiken
	University of South Carolina at Beaufort	Beaufort
	University of South Carolina at Spartanburg	Spartanburg
	University of South Carolina at Union	Union
	Voorhees College	Denmark
	Winthrop College	Rock Hill
	Wofford College	Spartanburg
SD	Augustana College	Sioux Falls
	Black Hills State College	Spearfish
	Dakota Wesleyan University	Mitchell
	Freeman Junior College	Freeman
	National College of Business	Rapid City
	Northern State College	Aberdeen
	Presentation College	Aberdeen
	Sioux Falls College	Sioux Falls
	South Dakota School of Mines and Technology	Rapid City
	South Dakota State University	Brookings
	University of South Dakota-Springfield	Springfield
TN	Aquinas Junior College	Nashville
	Austin Peay State University	Clarksville
	Belmont College	Nashville
	Carson-Newman College	Jefferson City
	Chattanooga State Technical Community College	Chattanooga

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Christian Brothers College	Memphis
	Cleveland State Community College	Cleveland
	Columbia State Community College	Columbia
	Covenant College	Lookout Mountain
	Cumberland College	Lebanon
	David Lipscomb College	Nashville
	Dyersburg State Community College	Dyersburg
	East Tennessee State University	Johnson City
	Fisk University	Nashville
	Freed-Hardeman College	Henderson
	Free Will Baptist Bible College	Nashville
	George Peabody College for Teachers	Nashville
	Hiwassee College	Madisonville
	Jackson State Community College	Jackson
	King College	Bristol
	Knoxville College	Knoxville
	Lambuth College	Jackson
	LeMoyne-Owen College	Memphis
	Martin College	Pulaski
	Memphis State University	Memphis
	Middle Tennessee State University	Murfreesboro
	Milligan College	Milligan College
	Nashville State Technical Institute	Nashville
	Roane State Community College	Harriman
	Shelby State Community College	Memphis
	State Technical Institute at Memphis	Memphis
	Steed College	Johnson City
	Tennessee Technological University	Cookeville
	Tennessee Wesleyan College	Athens
	University of the South	Sewanee
	University of Tennessee	Knoxville
	University of Tennessee Center for Health Sciences	Memphis
	University of Tennessee at Martin	Martin
	University of Tennessee at Nashville	Nashville
	Vanderbilt University	Nashville
	Volunteer State Community College	Gallatin
	Walters State Community College	Morristown
TX	Abilene Christian University	Abilene
	Alvin Community College	Alvin
	Amarillo College	Amarillo
	American Technological University	Killeen
	Angelina College	Lufkin
	Angelo State University	San Angelo
	Austin College	Sherman
	Austin Presbyterian Technological Seminary	Austin
	Baylor College of Dentistry	Dallas
	Baylor College of Medicine	Houston
	Baylor University	Waco
	Bee County College	Beeville
	Blinn College	Brenham
	Brazosport College	Lake Jackson
	Cisco Junior College	Cisco
	Clarendon College	Clarendon
	College of the Mainland	Texas City
	Concordia Lutheran College	Austin
	Cooke County College	Gainesville
	Dallas Bible College	Dallas
	Dallas Christian College	Dallas
	Dallas County Community College District	
	Eastfield College	Mesquite
	El Centro College	Dallas
	Mountain View College	Dallas
	Richland College	Dallas

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Dallas Theological Seminary	Dallas
	Del Mar College	Corpus Christi
	DeVry Institute of Technology	Dallas
	East Texas Baptist College	Marshall
	East Texas State University	Commerce
	El Paso Community College	El Paso
	Frank Phillips College	Borger
	Galveston College	Galveston
	Grayson College	Denison
	Gulf Coast Bible College	Houston
	Hardin-Simmons University	Abilene
	Henderson County Junior College	Athens
	Houston Baptist University	Houston
	Houston Community College	Houston
	Howard College at Big Spring	Big Spring
	Howard Payne University	Brownwood
	Huston-Tillotson College	Austin
	Incarnate Word College	San Antonio
	Jacksonville College	Jacksonville
	Jarvis Christian College	Hawkins
	Kilgore College	Kilgore
	Lamar University	Beaumont
	Laredo Junior College	Laredo
	Lee College	Baytown
	Le Tourneau College	Longview
	Lon Morris College	Jacksonville
	Lubbock Christian College	Lubbock
	McLennan Community College	Waco
	McMurry College	Abilene
	Midland College	Midland
	Midwestern State University	Wichita Falls
	Navarro College	Corsicana
	North Harris County College	Houston
	North Texas State University	Denton
	Odessa College	Odessa
	Our Lady of the Lake University of San Antonio	San Antonio
	Pan American University	Edinburg
	Panola Junior College	Carthage
	Ranger Junior College	Ranger
	Rice University	Houston
	Saint Edward's University	Austin
	Sam Houston State University	Huntsville
	San Antonio College	San Antonio
	San Jacinto College	Pasadena
	Schreiner College	Kerrville
	Southern Bible College	Houston
	Southern Methodist University	Dallas
	South Plains College	Lovelland
	South Texas College of Law	Houston
	Southwestern Assemblies of God College	Waxahachie
	Southwestern Baptist Theological Seminary	Fort Worth
	Southwestern Christian College	Terrell
	Southwestern Union College	Keene
	Southwestern University	Georgetown
	Southwest Texas State University	San Marcos
	Stephen F. Austin State University	Nacogdoches
	Tarleton State University	Stephenville
	Tarrant County Junior College-Northeast Campus	Hurst
	Tarrant County Junior College-Northwest Campus	Fort Worth
	Tarrant County Junior College-South Campus	Fort Worth
	Texarkana College	Texarkana
	Texas A & I University	Kingsville

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Texas A & I University-Corpus Christi	Corpus Christi
	Texas A & I University-Laredo	Laredo
	Texas A & M University-Main Campus	College Station
	Texas A & M University Moody College of Marine Sciences and Maritime Resources	Galveston
	Texas Christian University	Fort Worth
	Texas College	Tyler
	Texas Lutheran College	Seguin
	Texas Southmost College	Brownsville
	Texas State Technical Institute-James Connally Campus	Waco
	Texas State Technical Institute-Mid-Continent Campus	Amarillo
	Texas State Technical Institute-Rio Grande Campus	Harlingen
	Texas Tech University	Lubbock
	Texas Wesleyan College	Fort Worth
	Texas Woman's University	Denton
	Trinity University	San Antonio
	Tyler Junior College	Tyler
	University of Dallas	Irving
	University of Houston-Main Campus	Houston
	University of Houston-Clear Lake City	Houston
	University of Houston-Victoria Campus	Victoria
	University of Texas-Arlington	Arlington
	University of Texas-Austin	Austin
	University of Texas at Dallas	Richardson
	University of Texas-El Paso	El Paso
	University of Texas Health Science Center at Dallas	Dallas
	University of Texas Health Science Center at Houston	Houston
	University of Texas Medical Branch at Galveston	Galveston
	University of Texas-San Antonio	San Antonio
	Vernon Regional Junior College	Vernon
	Victoria College	Victoria
	Weatherford College	Weatherford
	Western Texas College	Snyder
	West Texas State Universtiy	Canyon
	Wharton County Junior College	Wharton
	Wiley College	Marshall
UT	Brigham Young University	Provo
	Stevens Henager College	Ogden
	University of Utah	Salt Lake City
	Utah Higher Education System Office	
	University of Utah	Salt Lake City
	Utah State University	Logan
	Southern Utah State College	Cedar City
	Weber State College	Ogden
	College of Eastern Utah	Price
	Dixie College	Saint George
	Snow College	Ephraim
	Utah Technical College at Salt Lake City	Salt Lake City
	Westminster College	Salt Lake City

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
VT	Champlain College	Burlington
	Johnson State College	Johnson
	Lyndon State College	Lyndonville
	Marlboro College	Marlboro
	Middlebury College	Middlebury
	Norwich University	Northfield
	Saint Michael's College	Winooski
	School for International Training	Brattleboro
	Southern Vermont College	Bennington
	Trinity College	Burlington
	University of Vermont and State Agriculture College	Burlington
	Vermont Institute of Community Involvement	South Burlington
	Vermont Technical College	Randolph Center
	Windham College	Putney
VA	Averett College	Danville
	Bridgewater College	Bridgewater
	College of William and Mary	Williamsburg
	Eastern Mennonite College	Harrisonburg
	Eastern Virginia Medical School	Norfolk
	Emory and Henry College	Emory
	Ferrum College	Ferrum
	Hampton Institute	Hampton
	Institute of Textile Technology	Charlottesville
	J. Sargeant Reynolds Community College	Richmond
	Madison University	Harrisonburg
	Old Dominion University	Norfolk
	Radford College	Radford
	Randolph-Macon College	Ashland
	Randolph-Macon Woman's College	Lynchburg
	Saint Paul's College	Lawrenceville
	University of Virginia	Charlottesville
	Virginia Intermont College	Bristol
	Virginia Military Institute	Lexington
	Virginia Polytechnic Institute and State University	Blacksburg
	Virginia Wesleyan College	Norfolk
	Washington and Lee University	Lexington
	Wytheville Community College	Wytheville
WA	Bellevue Community College	Bellevue
	Big Bend Community College	Moses Lake
	Centralia College	Centralia
	Central Washington State College	Ellensburg
	Clark College	Vancouver
	Columbia Basin Community College	Pasco
	Cornish School of Allied Arts	Seattle
	Eastern Washington State College	Cheney
	Evergreen State College	Olympia
	Fort Steilacoom Community College	Tacoma
	Fort Wright College of the Holy Names	Spokane
	Gonzaga University	Spokane
	Grays Harbor College	Aberdeen
	Green River Community College	Auburn
	Highline Community College	Midway
	Lower Columbia College	Longview
	Lutheran Bible Institute of Seattle	Seattle
	Northwest College of the Assemblies of God	Kirkland
	Olympia Technical Community College	Olympia
	Olympic College	Bremerton
	Pacific Lutheran University	Tacoma
	Peninsula College	Port Angeles

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Seattle Community College District	
	North Seattle Community College	Seattle
	Seattle Community College-Central Campus	Seattle
	Seattle Community College-South Campus	Seattle
	Seattle University	Seattle
	Shoreline Community College	Seattle
	Skagit Valley College	Mount Vernon
	Tacoma Community College	Tacoma
	University of Puget Sound	Tacoma
	Walla Walla College	College Place
	Walla Walla Community College	Walla Walla
	Washington State Community College-District 5	
	Edmonds Community College	Lynnwood
	Everett Community College	Everett
	Washington State Community College-District 17	
	Spokane Falls Community College	Spokane
	Washington State University	Pullman
	Wenatchee Valley College	Wenatchee
	Western Washington State College	Bellingham
	Whatcom Community College	Bellingham
	Whitman College	Walla Walla
	Whitworth College	Spokane
	Yakima Valley College	Yakima
WV	Alderson Broaddus College	Phillippi
	Beckley College	Beckley
	Bethany College	Bethany
	Bluefield State College	Bluefield
	Concord College	Athens
	Davis and Elkins College	Elkins
	Glenville State College	Glenville
	Marshall University	Huntington
	Morris Harvey College	Charleston
	Parkersburg Community College	Parkersburg
	Potomac State College	Keyser
	Salem College	Salem
	West Liberty State College	West Liberty
	West Virginia Institute of Technology	Montgomery
	West Virginia University	Morgantown
	Wheeling College	Wheeling
WI	Alverno College	Milwaukee
	Beloit College	Beloit
	Blackhawk Technical Institute	Janesville
	Cardinal Stritch College	Milwaukee
	Carroll College	Waukesha
	Carthage College	Kenosha
	Concordia College	Milwaukee
	District One Technical Institute	Eau Claire
	Edgewood College	Madison
	Fox Valley Technical Institute	Appleton
	Gateway Technical Institute	Kenosha
	Holy Redeemer College	Waterford
	Institute of Paper Chemistry	Appleton
	Lakeshore Technical Institute	Cleveland
	Lawrence University	Appleton
	Madison Area Technical College	Madison
	Madison Business College	Madison
	Marian College of Fond Du Lac	Fond Du Lac
	Marquette University	Milwaukee
	Mid-State Technical Institute	Wisconsin Rapids
	Milton College	Milton

APPENDIX V

CATALOGS REVIEWED

STATE	INSTITUTION	LOCATION
	Milwaukee Area Technical College	Milwaukee
	Moraine Park Vocational, Technical and Adult Education Institute	Fond Du Lac
	Mount Mary College	Milwaukee
	Mount Senario College	Ladysmith
	Nicolet College and Technical Institute	Rhinelander
	North Central Technical Institute	Wausau
	Northeast Wisconsin Technical Institute	Green Bay
	Northland College	Ashland
	Ripon College	Ripon
	Saint Norbert College	De Pere
	Silver Lake College	Manitowoc
	Southwest Wisconsin Vocational-Technical Institute	Fennimore
	University of Wisconsin-Green Bay	Green Bay
	University of Wisconsin-Madison	Madison
	University of Wisconsin-Milwaukee	Milwaukee
	University of Wisconsin-System Office	Madison
	Viterbo College	La Crosse
	Waukesha County Technical Institute	Pewaukee
	Western Wisconsin Technical Institute	La Crosse
WY	Casper College	Casper
	Eastern Wyoming College	Torrington
	Laramie County Community College	Cheyenne
	Northwest Community College	Powell
	Sheridan College	Sheridan
	University of Wyoming	Laramie
	Western Wyoming Community College	Rock Springs